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Evaluation of September 2003 Preliminary Performance Data For the Interim Action

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DOE, 2002. Characterization of Ground Water Brine Zones at the Moab Project Site (Phase I), Draft Final, GJO-2002-333-TAR, U.S. Department of Energy, Grand Junction, Colorado, June.

DOE, 2003. Site Observational Work Plan for the Moab, Utah, Site, GJO-2003-424-TAC, U.S. Department of Energy, Grand Junction, Colorado, December.

DOE, 2004. Operations, Maintenance, and Performance Monitoring Plan for the Interim Action Ground Water Treatment System, Moab, Utah, Site, GJO-2004-560-TAC, U.S. Department of Energy, Grand Junction, Colorado, February.

Preliminary Calc. ☐ **Final Calc.** ☒ **Supersedes Calc. No.** _____

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Moab Project

Evaluation of September 2003 Preliminary Performance Data For the Interim Action

February 2004

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1.0 Introduction

The analyses of ground water quality samples and the measurement of water levels prior to the startup of the interim action ground water extraction system (Figure 1) have provided a baseline data set upon which subsequent data can be compared to evaluate the performance of the system. This baseline data set is presented in Section 3.0 of the *Moab Project Operations, Maintenance, and Performance Monitoring Plan for the Interim Action Ground Water Treatment System, Moab, Utah, Site* (DOE 2004).

Since the startup of the system in July 2003, various data have been collected regarding the well field operation and the aquifer response to ground water withdrawal. In addition, data regarding the discharge of the extracted ground water into the evaporation pond, and water surface fluctuations of the pond have also been collected.

The objective of this document is to present the results of the evaluation of the preliminary performance data collected since the startup of the system through December 2003, at which time the system was shut down for the winter. The system evaluation is based upon the following:

- Comparison of ground water samples collected after the startup of the system to the baseline data set
- Extent of the cone of influence generated by the extraction well field
- Evaporation pond water level data and volume changes since water has been transported to the pond

The Colorado River stage at the time the data are collected needs to be taken into account when comparing data sets. Not only does the stage of the river impact the ground water elevations, but previous investigations (DOE 2003) have exhibited that the elevation of the fresh water/brine interface fluctuates in response to changes in the river stage, especially during the spring runoff.

2.0 Data Collection

System operational data have been collected from both the extraction well field and the evaporation pond at various times since the system startup in July 2003. The collection of these data sets will be discussed separately in this section.

2.1 Well Field Ground Water Quality Data Collection

In September 2003 vertical profile (up to two ft intervals) ground water samples were collected from each extraction and observation well. Prior to this sampling event, the ground water extraction system was shut down for 10 days. Observation well sampling was completed using a peristaltic pump. Extraction well sampling conducted prior to restarting the system was also completed using a peristaltic pump. Discharge water samples from the extraction wells were collected using submersible pumps (once the system was restarted). Field parameters (temperature, pH, and specific conductance) were measured in the field using a calibrated YSI 6920. All samples were analyzed by the Analytical Chemistry Laboratory at Grand Junction for ammonia, chloride, sulfate, TDS and uranium.

2.2 Well Field Ground Water Elevation Data Collection

Ground water elevation data were collected since September 2003 from 5 of the 10 extraction wells and 4 of the 6 observation wells using pressure transducers attached to data loggers. These instruments, which have been programmed to record data every 2 hrs, were last downloaded in October 2003. Hand measured water level data were also collected on a biweekly basis since September 2003.

A pressure transducer was also installed in well 403, located between the well field and the Colorado River (60 ft east of extraction well 478), to act as a background well to monitor the alluvial aquifer water level changes in response to Colorado River fluctuations during the early stages of operation. Over time an alternative background well may be required because of the well's close proximity to the well field.

2.3 Well Field Performance Data Collection

Data associated with the performance of the well field have been collected since early October 2003 on a bi-weekly basis. These data include the pumping rate and volume of ground water removed, discharge water field parameters (temperature, pH, and specific conductance), and hand-measured depth to water measurements from each extraction well. In addition, ground water surface elevation data were collected from each of the six observation wells.

2.4 Evaporation Pond Data Collection

Water quality measurements of the water entering the pond and the water stored in the pond (in the form of field parameters) and the pond level have been measured on a bi-weekly basis from September 25, 2003 through December 27, 2003. The pond is also equipped with a pressure transducer to provide a continuous record of the water level inside the pond.

The water level can be converted into a volume of water contained within the pond based on Table 3–8 of the *Moab Project Operations, Maintenance, and Performance Monitoring Plan for the Interim Action Ground Water Treatment System, Moab, Utah, Site* (DOE 2004). Taking into account the changes in the volume of water contained within the pond (based on the water level changes) and the volume transported to the pond (based on the extraction well field flow meter totalizer), the net gain or loss to the system can be calculated.

3.0 Data Evaluation

This section summarizes the results of the data evaluation regarding the ground water quality, aquifer response to pumping from the extraction well field, and the solar evaporation pond. These topics will be discussed separately.

3.1 Ground Water Quality Data

Figures 2 through 11 present the results of the September 2003 sampling effort for extraction wells 470 through 479, respectively. These figures also present the results of the baseline sampling completed in July 2003 for comparison purposes.

Figures 12, 13, and 14 are plots generated using the baseline and September 2003 specific conductance, ammonia, and uranium data, respectively. A significant increase in the specific conductance data between the baseline data and the September 2003 data may be an indicator that the removal of ground water from the ten extraction wells is causing upconing of the underlying brine unit. As shown in Figure 12, in general the September 2003 measured specific conductance range extends beyond the baseline range. Of the 7 wells that have increased specific conductance, only 3 have increases greater than 10 percent (well 471 increased ~17 percent, well 478 increased ~ 13 percent, and well 479 increased ~ 24 percent). It should be kept in mind that these data were collected under different field conditions, most notably various river stages.

As shown in Figure 13, baseline ammonia data were limited to only one data point (from a single depth), while the September 2003 data included samples collected from five depths (see Figures 1-10). The data were displayed together to show where the single baseline ammonia concentration lies compared to the range of data collected in September 2003. The samples collected in September 2003 from 8 of the 10 extraction wells contained higher ammonia concentrations (wells 472 and 476 were the exceptions). However, this comparison does not necessarily indicate the extraction of ground water is increasing the ammonia concentrations because of the different sampling depths at which these samples were collected. Subsequent data may provide an explanation of this response.

Figure 14 presents the comparison of the uranium concentrations. Ground water samples collected in September 2003 from each extraction well location contained lower uranium concentrations compared to the baseline concentrations.

Table 1 presents the sulfate/chloride ratios that are plotted versus the sample depths from the ten extraction wells in Figure 15. This plot was generated to further analyze the data and segregate the water types. A similar type of analysis was completed on data collected during the initial brine characterization field investigation (DOE 2002). This initial data suggested that in the vicinity of well cluster PW-02 (which is located approximately 250 ft northwest from the extraction well field) two distinct types of water are present. Ground water samples collected from the surface down to a depth of approximately 35 ft bgs have sulfate/chloride ratios of greater than 4.0, which is indicative of fresh water. Brine samples collected below 35 ft had ratio values less than 1.0.

As Table 1 and Figure 15 show, samples collected as part of the baseline investigation had sulfate/chloride ratios that ranged from 1.70 (well 471) to 2.86 (well 479). Samples collected from the September 2003 sampling event had ratios ranging from 1.23 (wells 478 and 479) to 3.77 (well 478). In general, the deeper the sample was collected, the lower the sulfate/chloride ratio (i.e., the water type transitions from more fresh water to having more brine characteristics). The analysis of samples collected during the baseline sampling and September 2003 sampling events suggests the ground water is a mixture of the two ground water types, and pure brine (defined as TDS concentrations greater than 35,000 mg/L) has not entered the wells.

Table 1. Extraction Well Sulfate/Chloride Ratio Data, July and September 2003

Well	Depth (ft bgs)	Sulfate (mg/L)	Chloride (mg/L)	Ratio	Well	Depth (ft bgs)	Sulfate (mg/L)	Chloride (mg/L)	Ratio
470	*18*	*10023*	*5357*	*1.87*	475	*18*	*9975*	*4822*	*2.07*
	15	8560	4730	1.81		15	9130	4240	2.15
	16	9460	6570	1.44		16	9120	4510	2.02
	17	**9790**	**7660**	**1.28**		17	9460	4840	1.95
	18	9960	8750	1.14		**17**	**9250**	**4820**	**1.92**
	19	9740	7900	1.23		19	9710	5370	1.81
471	*18*	*10038*	*5902*	*1.70*	476	*18*	*9865*	*4755*	*2.07*
	15	9170	5590	1.64		15	8820	4200	2.10
	16	9950	7300	1.36		16	9130	4630	1.97
	17	**9840**	**7640**	**1.29**		17	9080	4610	1.97
	18	11500	8510	1.35		**17**	**8780**	**4370**	**2.01**
	19	10100	8360	1.21		19	9110	4810	1.89
472	*18*	*9461*	*4403*	*2.15*	477	*18*	*10062*	*4821*	*2.09*
	15	8820	3340	2.64		15	8300	2920	2.84
	16	8680	3730	2.33		16	8880	3920	2.27
	17	**9580**	**5640**	**1.70**		17	9130	4400	2.08
	18	9480	5250	1.81		**17**	**8910**	**3970**	**2.24**
	19	9520	5850	1.63		19	9280	5030	1.84
473	*18*	*9721*	*4507*	*2.16*	478	*18*	*9872*	*3669*	*2.69*
	15	8690	2970	2.93		15	8260	2190	3.77
	16	9440	4120	2.29		17	9160	4770	1.92
	17	**9160**	**4430**	**2.07**		**17**	**8840**	**4030**	**2.19**
	18	9800	5860	1.67		20	10900	8610	1.27
	19	9600	5010	1.92		23	10700	8680	1.23
474	*18*	*9832*	*4774*	*2.06*	479	*18*	*9797*	*3424*	*2.86*
	15	9180	4070	2.26		15	8300	2310	3.59
	16	9550	5090	1.88		**17**	**8930**	**3390**	**2.63**
	17	9700	5380	1.80		18	9950	6180	1.61
	17	**9130**	**4920**	**1.86**		21	10800	8050	1.34
	19	9950	6250	1.59		23	10500	8520	1.23

Notes: *Baseline data (July 2003) presented in italics (first sample listed, from 18 feet)*
Samples collected using submersible pumps after system startup are presented in bold

Figures 16 through 21 present the results of the September 2003 sampling effort for observation wells 480 through 485, respectively. These figures also present the results of the baseline sampling completed in July 2003 for comparison purposes.

Figures 22, 23, and 24 are plots generated using the baseline and September 2003 specific conductance, ammonia, and uranium data, respectively. As shown in Figure 22, there is not a significant difference (less than 10 percent) between the specific conductance measured during the baseline and September 2003 sampling. Figure 23 shows wells 480 and 482 had lower ammonia concentrations in September 2003 compared to the baseline data, while wells 481, 483, 484, and 485 had higher concentrations. With the exception of well 481, all observation wells had lower uranium concentrations in September 2003 compared to the baseline data (Figure 24).

Table 2 presents the sulfate/chloride ratios that are plotted versus the sample depths from the six observation wells in Figure 25. As the plot shows, there is not a significant difference between the baseline data and the September 2003.

Table 2. Observation Well Sulfate/Chloride Ratio Data, September 2003

Well	Depth (ft bgs)	Sulfate (mg/L)	Chloride (mg/L)	Ratio	Well	Depth (ft bgs)	Sulfate (mg/L)	Chloride (mg/L)	Ratio
480	17.5	*10594*	*6224*	*1.70*	483	17.5	*10017*	*4979*	*2.01*
	16	9810	3340	2.94		16	9510	4920	1.93
	18	11200	7940	1.41		18	9500	5230	1.82
	19	9920	8000	1.24		19	9830	6130	1.60
481	27.5	*10955*	*8165*	*1.34*	484	27.5	*11085*	*8139*	*1.36*
	26	9980	7370	1.35		26	9960	8480	*1.17*
	28	10100	7710	1.31		28	11000	8760	*1.26*
	29	9980	7400	1.35		29	9900	8630	*1.15*
482	57.5	*7224*	*47023*	*0.15*	485	57.5	*6981*	*46987*	*0.15*
	56	6990	47900	0.15		56	6500	48700	0.13
	58	6700	47200	0.14		58	6610	48300	0.14
	59	6850	48300	0.14		59	6430	48200	0.13

Notes: *Baseline data (July 2003) presented in italics*

The sulfate/chloride ratios of samples collected from the shallow observation wells during the September 2003 sampling event range from 1.24 to 2.94, while the baseline samples range from 1.70 to 2.01. Ratios of samples from the middle completion observation wells range from 1.15 to 1.35 and 1.34 to 1.36 for the September 2003 and baseline data, respectively. Samples collected from the deepest completions had ratios that ranged only from 0.13 to 0.15, and is consistent with the values measured from samples collected at depth during previous investigations (DOE 2002). The ratios of samples collected from the deepest observation wells are indicative of brine, while the shallower ground water represents a mixture of fresh water and brine.

3.2 Ground Water Elevation Data

Background ground water elevation data were measured in well 403 to provide representative ground water changes in response to river level fluctuations during the early stages of operation (as previously discussed). Figure 26 presents the data collected from the well 403 data logger along with the Colorado River flow (in cfs) measured at the USGS Cisco gaging station. As the plot shows, there is approximately 1 day lag time between when changes in the river are measured at well 403. However, the data logger is sensitive to changes in the river flow and confirms the water level changes are representative of background conditions.

A systematic shutdown of the well field was conducted on September 8, 2003, to monitor how the aquifer responds after prolonged pumping. Prior to the shutdown, water levels and water discharge water parameters were measured in all extraction wells. Then wells 471, 473, 476, and 478 were taken off line and more water level and discharge water parameter data (from the remaining wells) were collected. After 2 hours, the remaining extraction wells were also shut off. All data collected during this system shutdown are contained in Appendix A (A1.0).

A similar procedure was followed when the system was restarted on September 19, 2003, in an attempt to determine the lateral extent of the cone of depression generated by the extraction wells. Wells 470, 472, 474, 475, 477, and 479 were first brought online after collecting background data. Water levels were measured in wells located adjacent to any of the active extraction wells once pumping started. After 4.25 hours of pumping, the pumps in the remaining extraction wells were restarted. Appendix A also contains the data collected during this restart procedure (A2.0).

Extraction wells 470, 472, 474, 476, and 478 are equipped with data loggers to provide a more continuous record of water level changes over time. These data loggers were downloaded in late October 2003, and the data are presented with the background ground water elevation changes measured in well 403 as Figures 27 through 31, respectively.

The spikes displayed in these plots may be the result of system shutdown for maintenance purposes, sampling events, or the pumps cycling on and off. The sharp decline on September 19, 2003, marks the point where the extraction system was re-started after being shut down on September 8, 2003.

Observation wells 480, 481, 483, and 484 are also equipped with data loggers. The data downloaded in October 2003 are displayed with background water level data as Figures 32 through 35, respectively. As expected, these plots also exhibit a sharp decline after September 19, 2003. As the background water level data show, the river was dropping during this same time frame.

Table 3 provides the approximate amount of drawdown measured at these four observation wells on October 8, 2003, after 19 days of pumping starting on September 19, 2003. For these drawdown values, the change in the background elevation was taken into account, and subtracted from the drawdown measured by the data loggers.

Table 3. Drawdown Measured in the Observation Wells October 8, 2003, After 19 Days of Pumping

Well	Distance from the Extraction Well Centerline (ft)	Screen Interval (ft bgs)	Drawdown After 19 Days of Pumping (ft)
480	19	15.5 to 19.8	0.55
481	25	25.4 to 29.7	0.0
483	11	15.5 to 19.8	0.60
484	14	25.5 to 29.8	0.0

The measured drawdown suggests the cone of depression is extending at least 19 ft in the upgradient direction and at least 11 ft in the downgradient direction. In addition, the lack of drawdown measured in the well screened from approximately 25 to 30 ft bgs suggests the source of ground water extracted by the system is the most shallow zone of the alluvial aquifer.

As pumping continues, the extent of the cone of depression is expected to expand. As more data becomes available, it may be possible to further evaluate the aquifer response to pumping from the extraction well field. Figure 36 presents the approximate extent of the cone of depression in the vicinity of the middle of the extraction field measured on October 8, 2003.

The data collected from the middle completion wells (481 and 484) exhibit a constant fluctuation of approximately 0.1 ft on average, with the elevation peaking at approximately 1600 each day, and hitting a low point at approximately 0800. The source of this fluctuation is not known at this time, and will be further evaluated as more data becomes available.

3.3 Extraction Well Field Discharge Water Quality Data

Data collected through the end of December 2003 regarding the discharge water quality of the extraction well field are presented in Appendix B. This information includes the flow rate, water quality, and water level data for each extraction and observation well.

Figure 37 was generated using extraction well discharge water specific conductance data from September through December 2003. Table 4 presents the discharge water specific conductance measured in early September 2003, the final measurement taken prior to the December 2003 shut down, and the percent difference.

Table 4. Discharge Water Specific Conductance

Extraction Well Number	September 8, 2003 Specific Conductance (µS/cm)	December 22, 2003 Specific Conductance (µS/cm)	Difference (µS/cm) / %
470	31,200	27,020	-4,180 / -13%
471	33,480	30,240	-3,240 / -10%
472	31,640	29,690	-1,950 / -6%
473	26,010	25,960	-50 / -1%
474	26,160	27,370	1,210 / 5%
475	23,180	24,990	1,810 / 8%
476	23,330	24,260	930 / 4%
477	23,150	22,370	-780 / -3%
478	25,150	24,660	-490 / -2%
479	21,680	23,090	1,410 / 7%

As shown in Table 4, the largest difference between the two measurements was a 13 percent decrease in the specific conductance measured in the discharge from well 470. Figure 37 indicates there were no drastic fluctuations over the time the specific conductance was measured.

Figure 38 was generated using the specific conductance data combined with the flow rate data collected from each extraction well. The plot shows that the wells that were pumped at higher flow rates had discharge water with a higher specific conductance, and vice versa.

Once additional data are collected from this system, further and a more comprehensive data evaluation can be completed.

3.4 Solar Evaporation Data

The data set presented in Appendix C presents all data collected from the evaporation pond from late September through late December 2003, when the system was shut down for the winter. The pressure transducer was last downloaded in late October 2003, and only contains pond elevation data from October 2003 (Appendix C).

The approximate volume of water transported to the pond from the extraction well field, the approximate volume contained within the evaporation pond, and the net gain/loss to the system from October, November, and December 2003 is presented in Table 5. The ground water volume extracted by the well field was calculated from the flow meter totalizer located at the end of the well field discharge line, and the volume of water contained in the pond was based on changes of the evaporation pond water level.

Table 5. Change in Volume in the Evaporation Pond for October, November, and December 2003

Month	Approx Starting Volume (gal)	Approx Ending Volume (gal)	Approx Volume Change (gal)
Extraction Wells			
October 2003	1,226,149	2,190,682	964,533
November 2003	2,190,682	3,138,324	947,642
December 2003	3,138,324	3,936,619	798,295
Evaporation Pond			
October 2003	875,330	1,532,607	657,277
November 2003	1,532,607	2,847,810	1,315,203
December 2003	2,847,810	3,363,036	515,226
Total Volume Change (gal)[a]			
October 2003	-307,256		
November 2003	367,561		
December 2003	-283,069		

[a] Negative value represents net volume lost from the pond; positive value represents net volume gained in the pond.

The magnitude of total volume change estimated for November 2003 was unexpected, and the data is considered suspect at this time. As subsequent data are collected, this value may be revised.

4.0 Summary

The following is a summary of the comparison between the baseline and September 2003 water quality data sets:

- Seven of the ten extraction wells provided samples in September 2003 that contained higher specific conductance values that exceed the baseline range. Of these seven, only three had significant (greater than 10 percent) increases.
- Water samples collected from each extraction well in September 2003 contained higher ammonia concentrations compared to the baseline concentrations. Comparison of these data sets was difficult because of the inconsistent number of samples collected during each event.
- Uranium concentrations were lower in samples collected from each extraction well during the September 2003 sampling event.

- Sulfate/chloride ratio data collected during both the baseline and September 2003 sampling events indicates the extraction wells are producing a mixture of freshwater and brine type waters.
- Water samples collected from the observation wells does not indicate a significant difference (less than 10 percent) between the specific conductance measurements collected in the September 2003 and baseline sampling events.
- Similar to the extraction wells, in most cases the ammonia concentrations were higher and uranium concentrations were lower in samples collected from the observation wells in September 2003.
- Sulfate/chloride ratio data collected from the observation wells suggests the water collected from the shallow and middle observation wells is a mixture of freshwater and brine, while the deep observation wells are screened within the brine zone. There were insignificant differences between the baseline and September 2003 data sets regarding the sulfate/chloride ratios.

The following is a summary of the water elevation data in response to pumping from the extraction well field:

- Data collected from September through December 2003 indicates in general there was approximately 1 to 2 ft of drawdown in response to pumping from 2 to 5 gpm in the direct vicinity of the extraction wells. Drawdown measured in individual extraction wells ranged from 2 to 3 ft.
- Ground water elevation data collected from the observation wells indicates that there was 0.6 ft of drawdown 11 ft from the well field centerline, and 0.55 ft of drawdown 19 ft from the centerline in the shallow completions. No drawdown was measured in the middle or deep completions.
- Drawdown was measured in inactive extraction wells in response to pumping from adjacent active wells during the systematic shutdown and restart of the well field. This response suggests the cone of depressions generated by each extraction well overlap.

The following is a summary of the extraction well field performance since the startup through the winter shut down in December 2003:

- The specific conductance of the extraction well field discharge water initially ranged from 21,680 to 33,480 µS/cm in early October, and ranged from 22,370 to 30,240 µS/cm by late December 2003. In general, wells located in the northern half of the well field produced lower specific conductance discharge water compared to the southern half wells.
- The limited data suggest wells pumped at higher flow rates produced water having higher specific conductance concentrations.

The following is a summary of the solar evaporation pond performance since the startup through the winter shut down in December 2003:

- Approximately 307,256 gal of water was removed from the system in October 2003, and approximately 283,069 gal was removed in December 2003.
- The estimated volume of water gained in the pond in November 2003 is suspect, and may be revised as subsequent data are collected.

5.0 Recommendations

The following section outlines a number of recommendations regarding the data and monitoring requirements, system improvements, and application to the design of long-term remedy based on the information obtained from the system up to the end of December 2003.

The following recommendations regarding the data and monitoring requirements are designed to improve the future evaluation of the system:

- Additional sampling on a monthly basis will provide data that will provide insight into the effectiveness of the extraction system regarding ammonia concentrations and potential brine upconing due to pumping.
- The installation of an additional observation well cluster between the extraction well field and the Colorado River will provide insight into the extent of the cone of depression and the ammonia concentrations migrating to the river. This cluster should include shallow and middle completions (similar to the clusters previously installed onsite) in addition to a well screened from ~ 30 to 60 ft bgs. With a well screened over this depth, the elevation fluctuation of the freshwater/brine interface can be monitored.
- Install additional shallow observation wells along the length and at both ends of the extraction well field. Information obtained from these wells will allow more detailed delineation of the extent of the cone of depression.
- All new observation wells should be instrumented with pressure transducers to provide a continuous record of water elevations.

The following recommendations are made regarding system improvements:

- Replace all extraction well pumps (as needed) with pumps that allow the operator to control the extraction of ground water based on a number of options (desired fixed flow rate, water level, or pressure requirements). These pumps also allow for remote operation should the need arise.
- Set the pump intakes at depths of ~19 ft bgs. At this depth, the well can be pumped at higher flow rates during high river stage periods (when evaporation rate is higher) and the flow can be reduced during low stage periods without shutting down the system. In addition, the ammonia concentrations are greater at the bottom of the screened interval.

- Establish a well maintenance program that would include regular development of the extraction wells. The extraction wells should at a minimum be developed prior to springtime startup and once during the course of the year. Development should consist of surging and bailing techniques in conjunction with the use of bioacid dispersants to control biological growth inside the well, clay dispersants to eliminate the accumulation of clay in the sand pack, and liquid acids to remove mineral buildup in the well screen.

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Figures

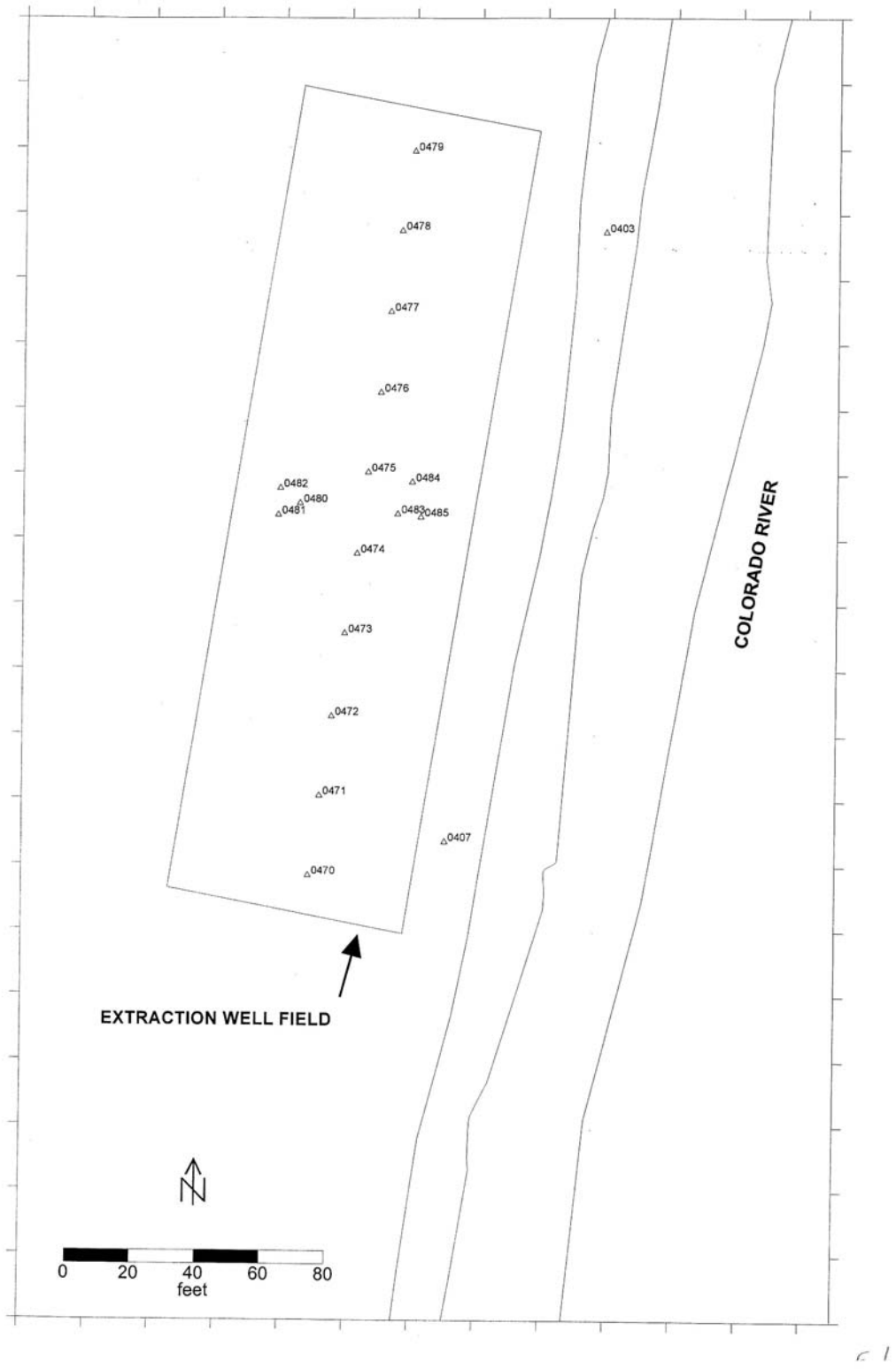


Figure 1. Interim Action Ground Water Extraction System Site Map

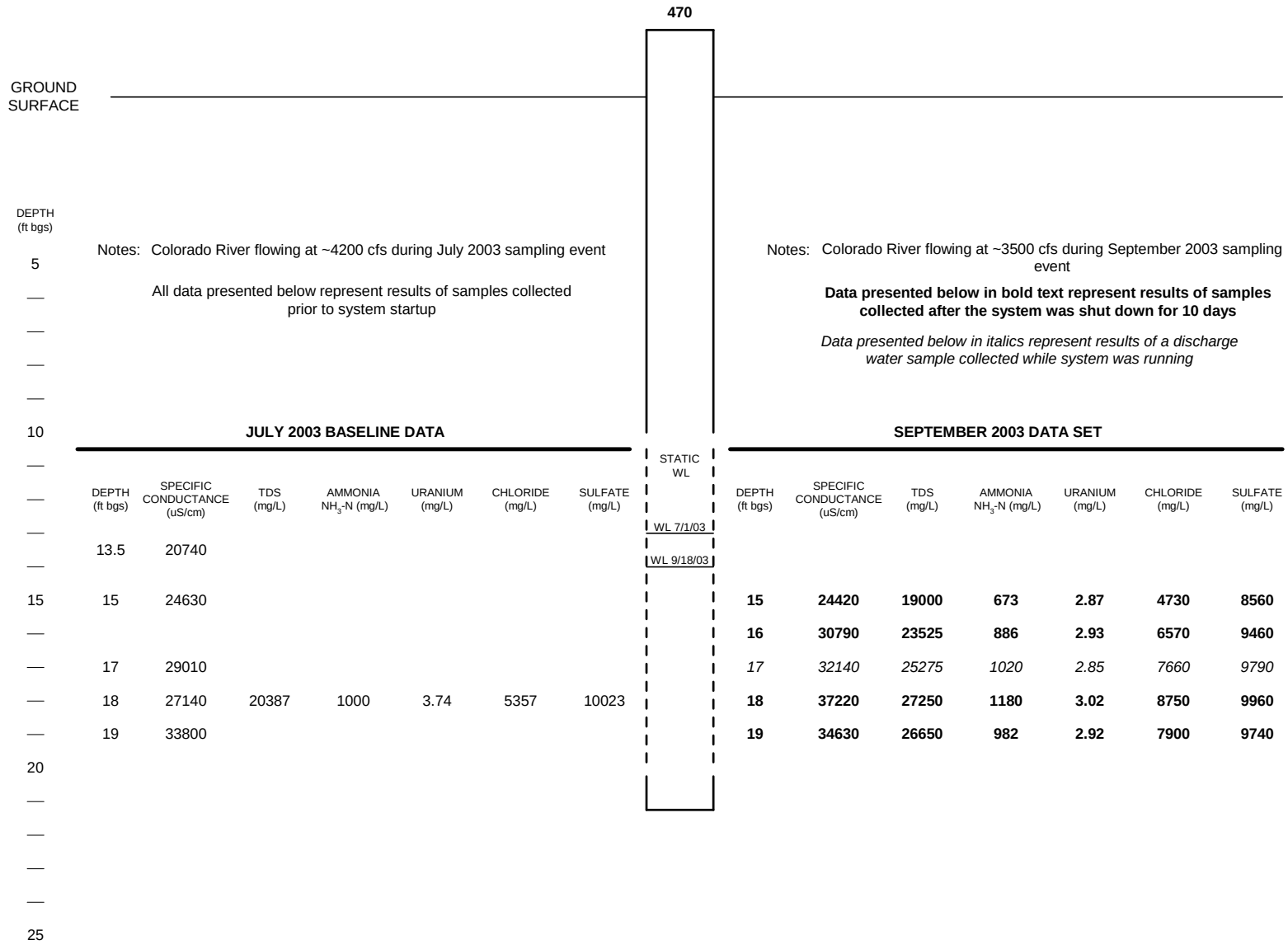


Figure 2. Extraction Well 470 Baseline and September 2003 Ground Water Quality Data

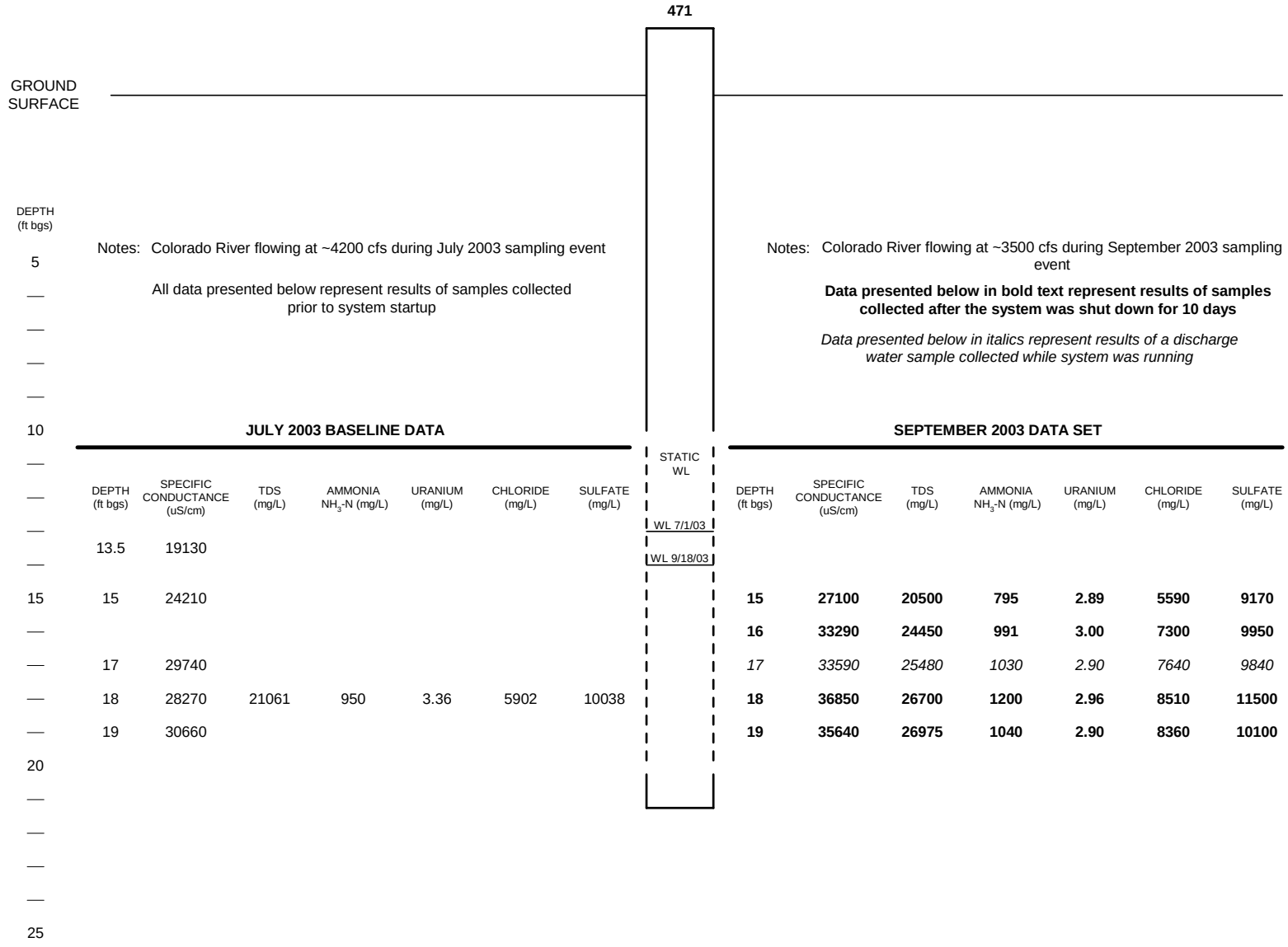


Figure 3. Extraction Well 471 Baseline and September 2003 Ground Water Quality Data

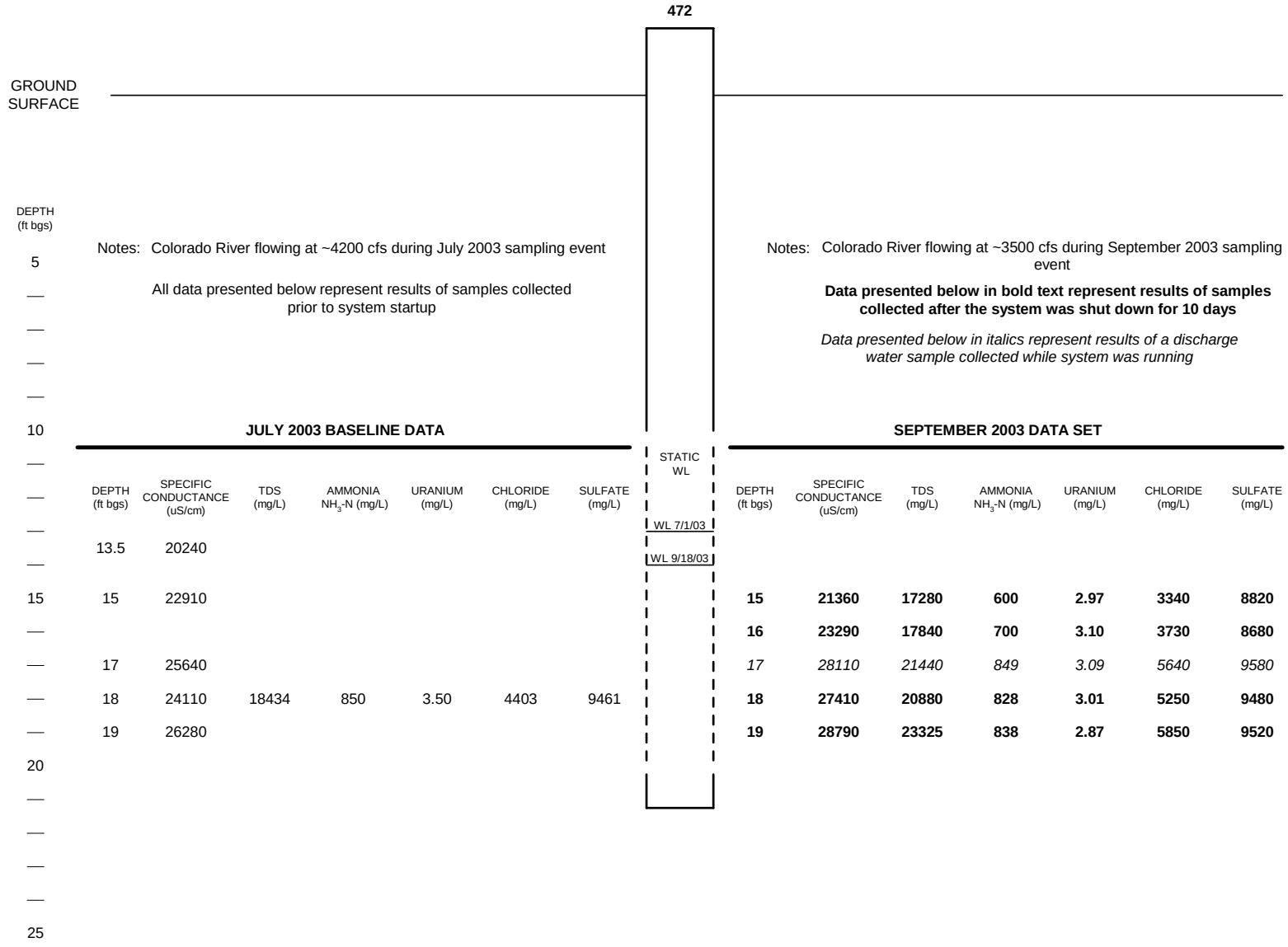


Figure 4. Extraction Well 472 Baseline and September 2003 Ground Water Quality Data

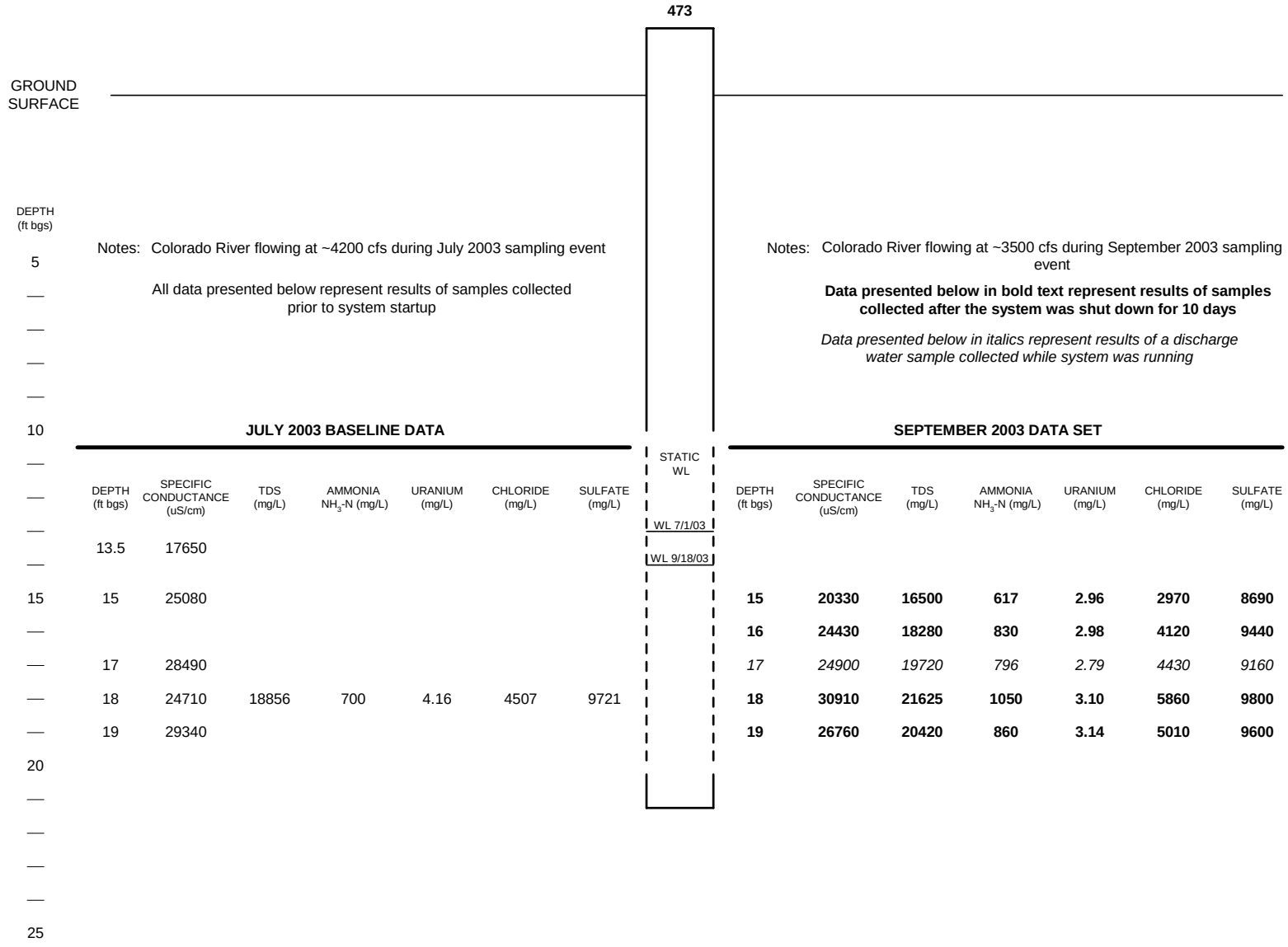


Figure 5. Extraction Well 473 Baseline and September 2003 Ground Water Quality Data

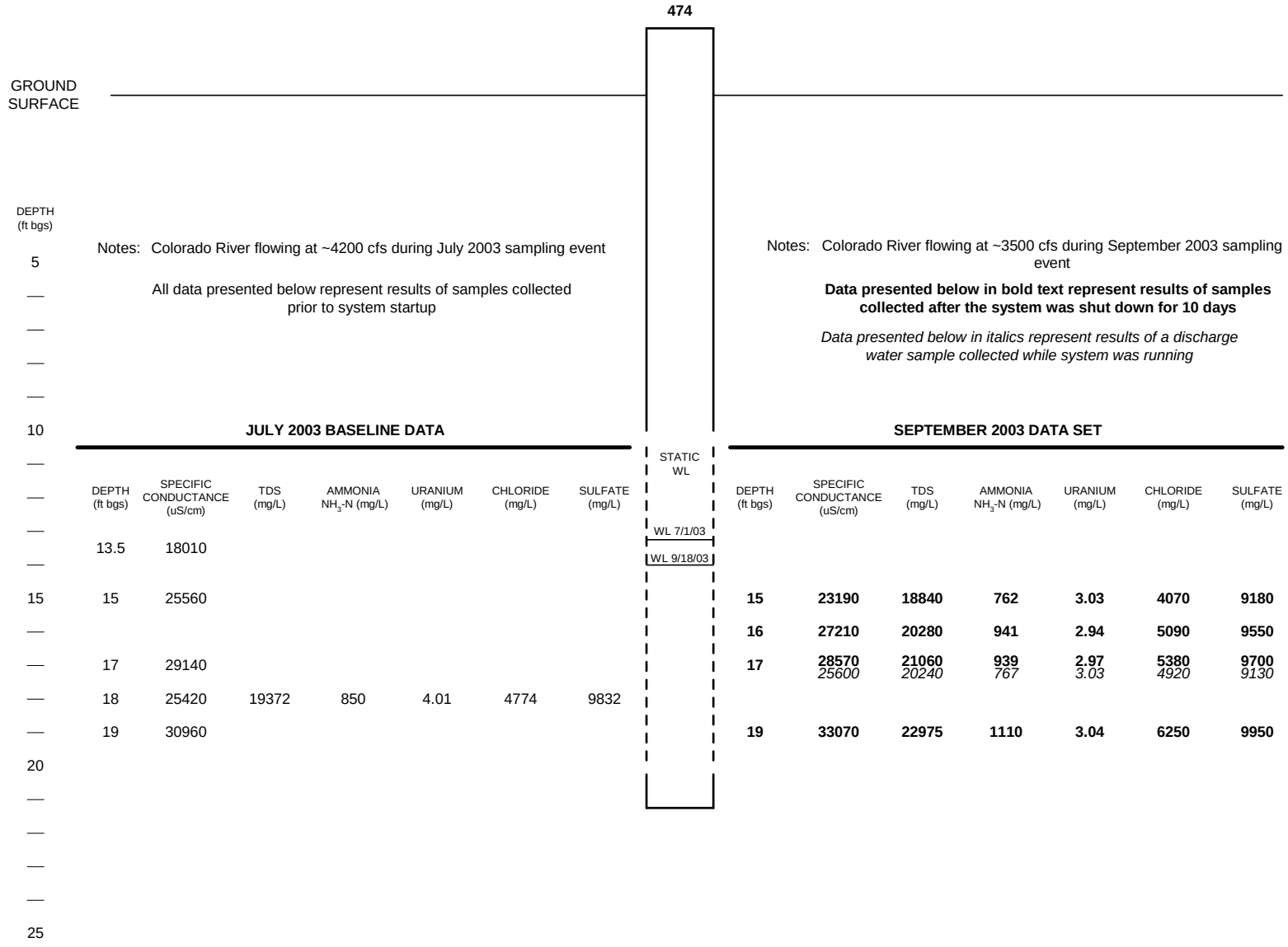


Figure 6. Extraction Well 474 Baseline and September 2003 Ground Water Quality Data

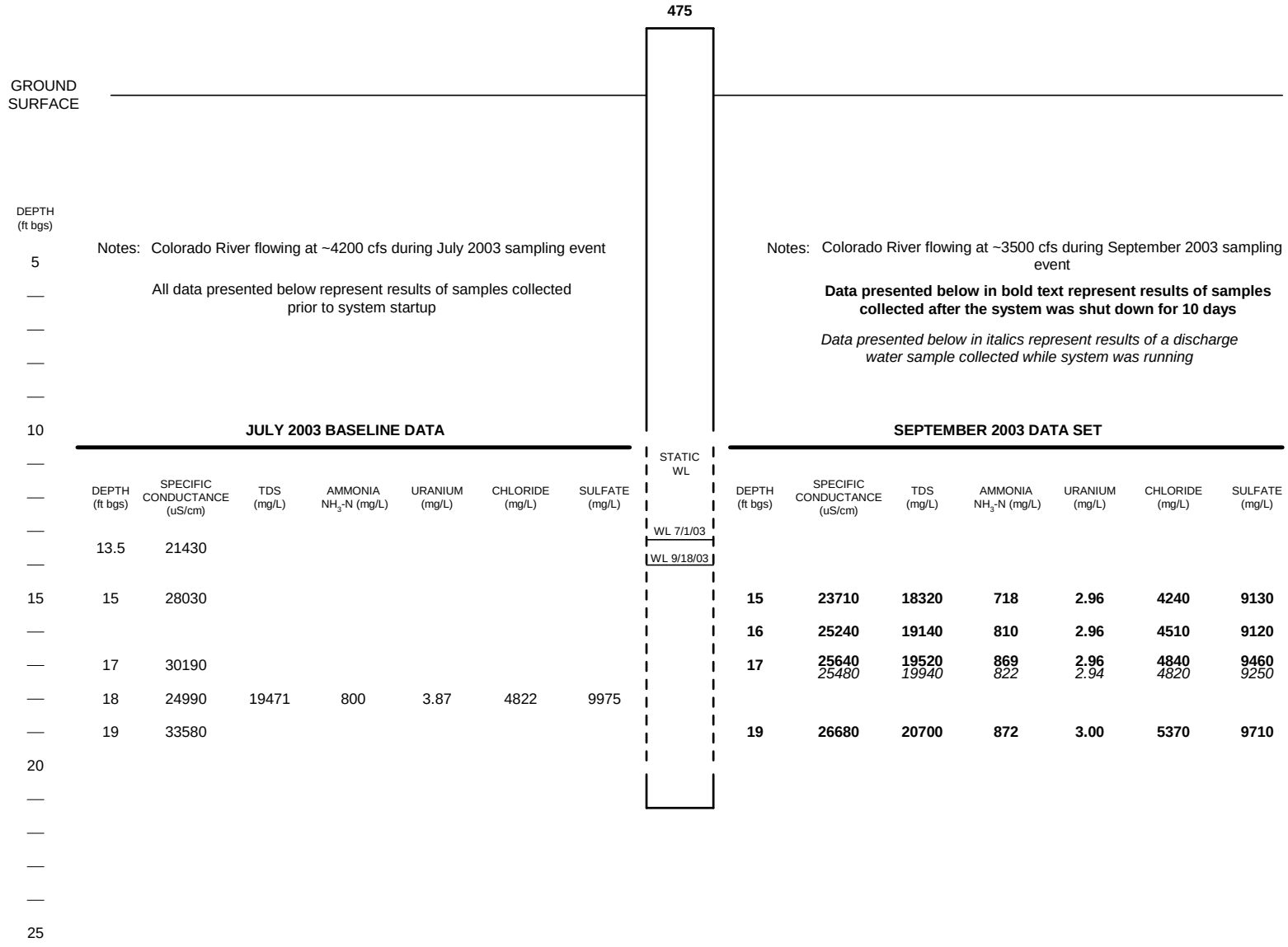


Figure 7. Extraction Well 475 Baseline and September 2003 Ground Water Quality Data

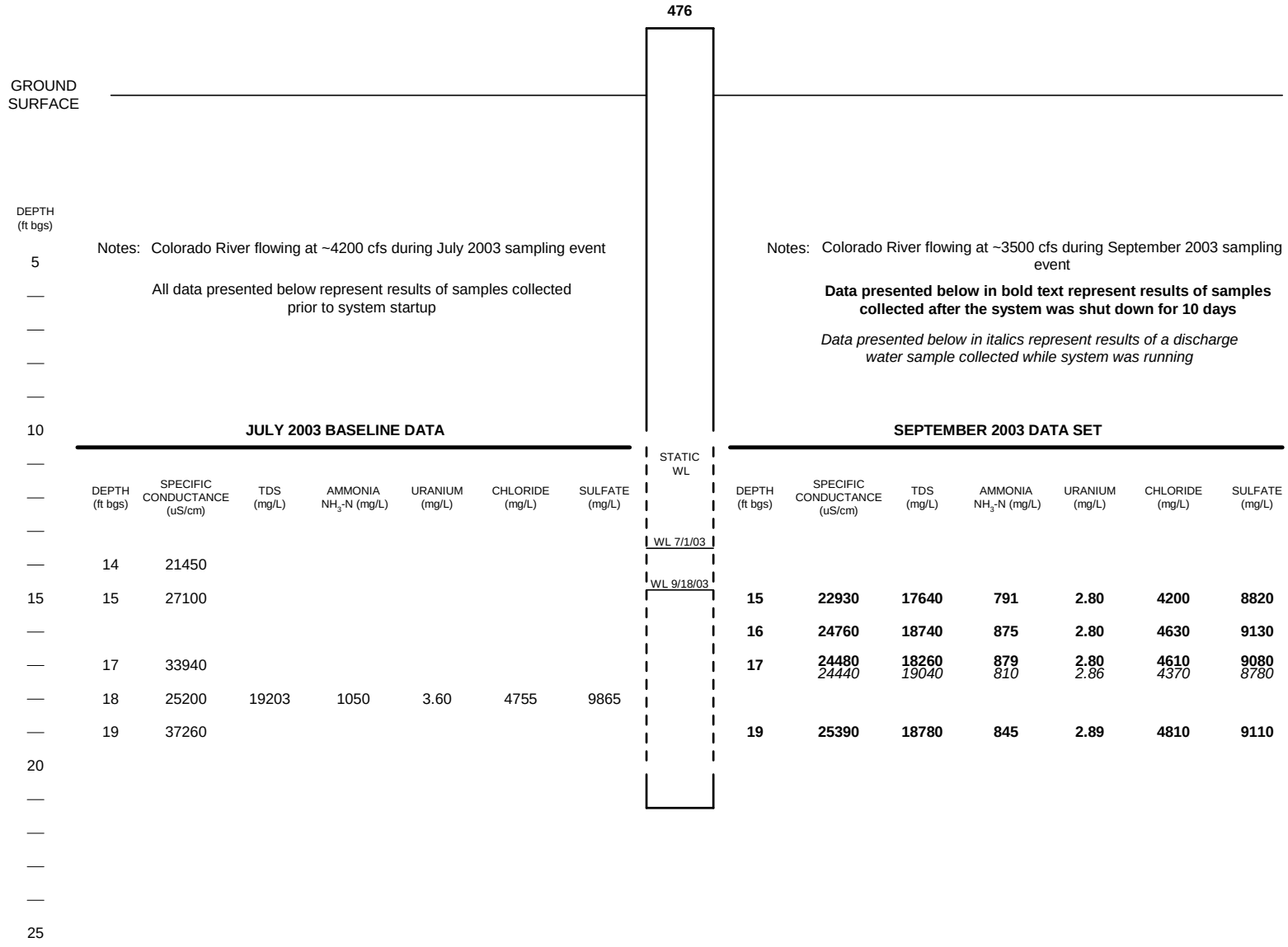


Figure 8. Extraction Well 476 Baseline and September 2003 Ground Water Quality Data

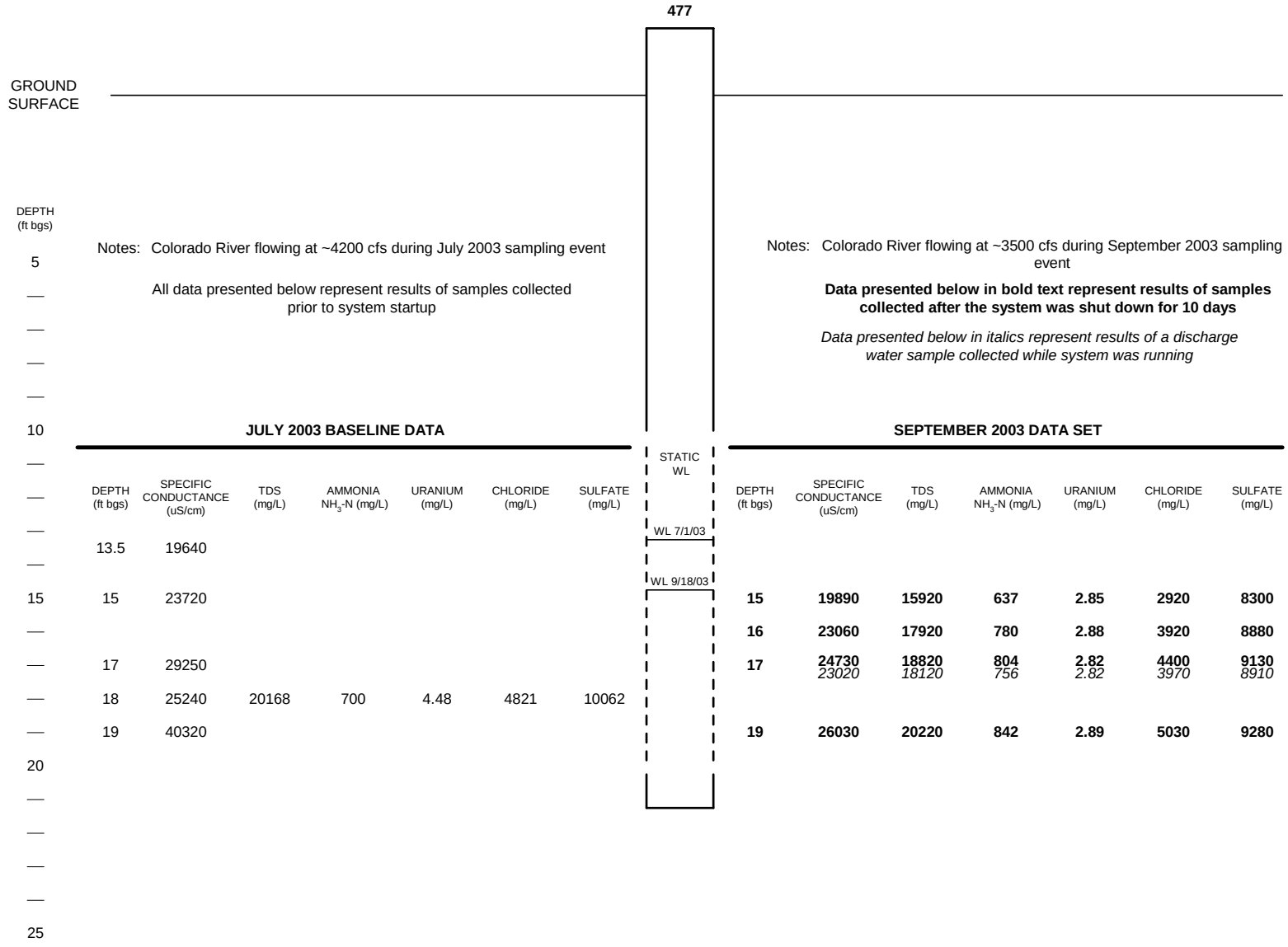


Figure 9. Extraction Well 477 Baseline and September 2003 Ground Water Quality Data

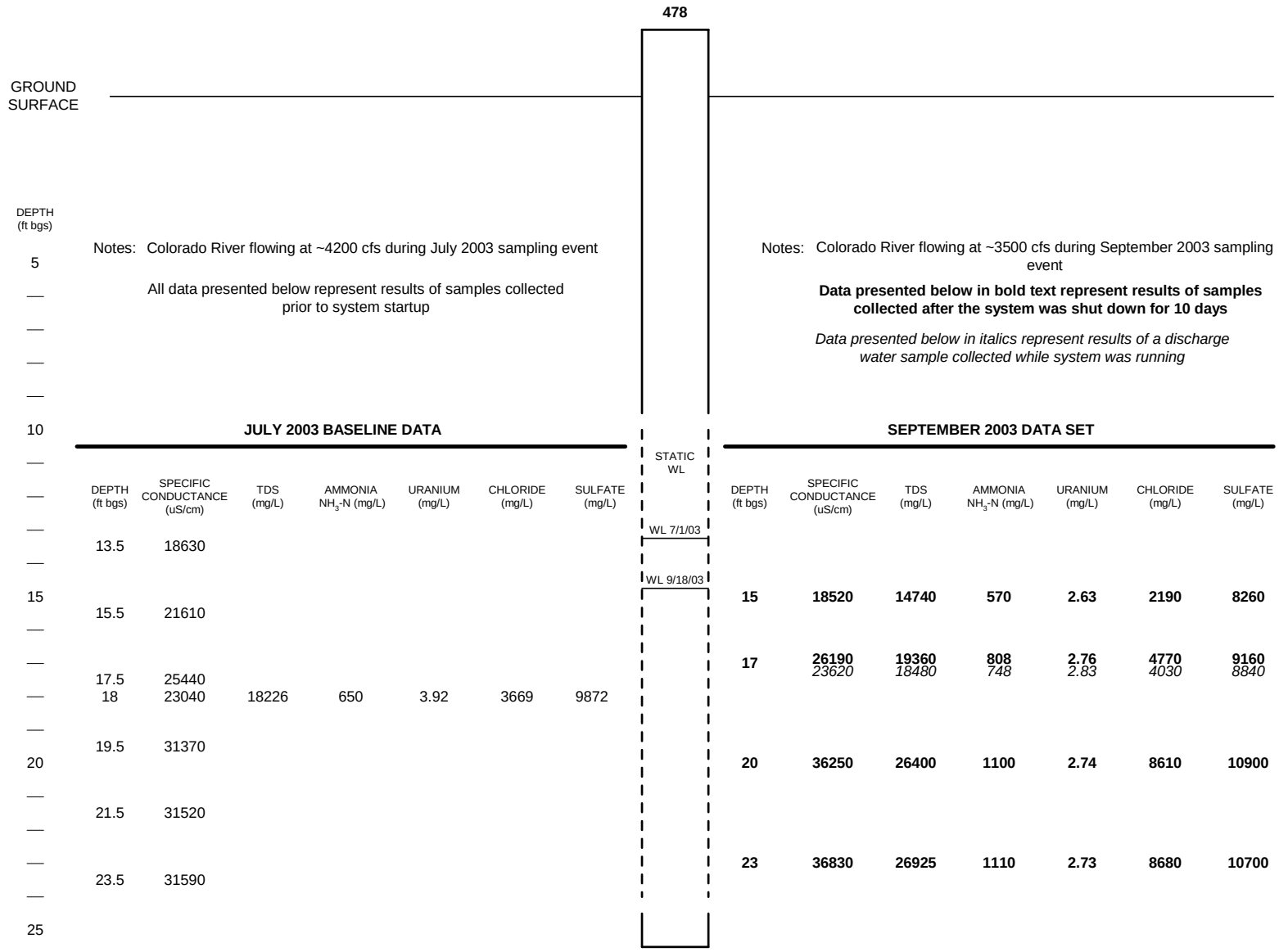


Figure 10. Extraction Well 478 Baseline and September 2003 Ground Water Quality Data

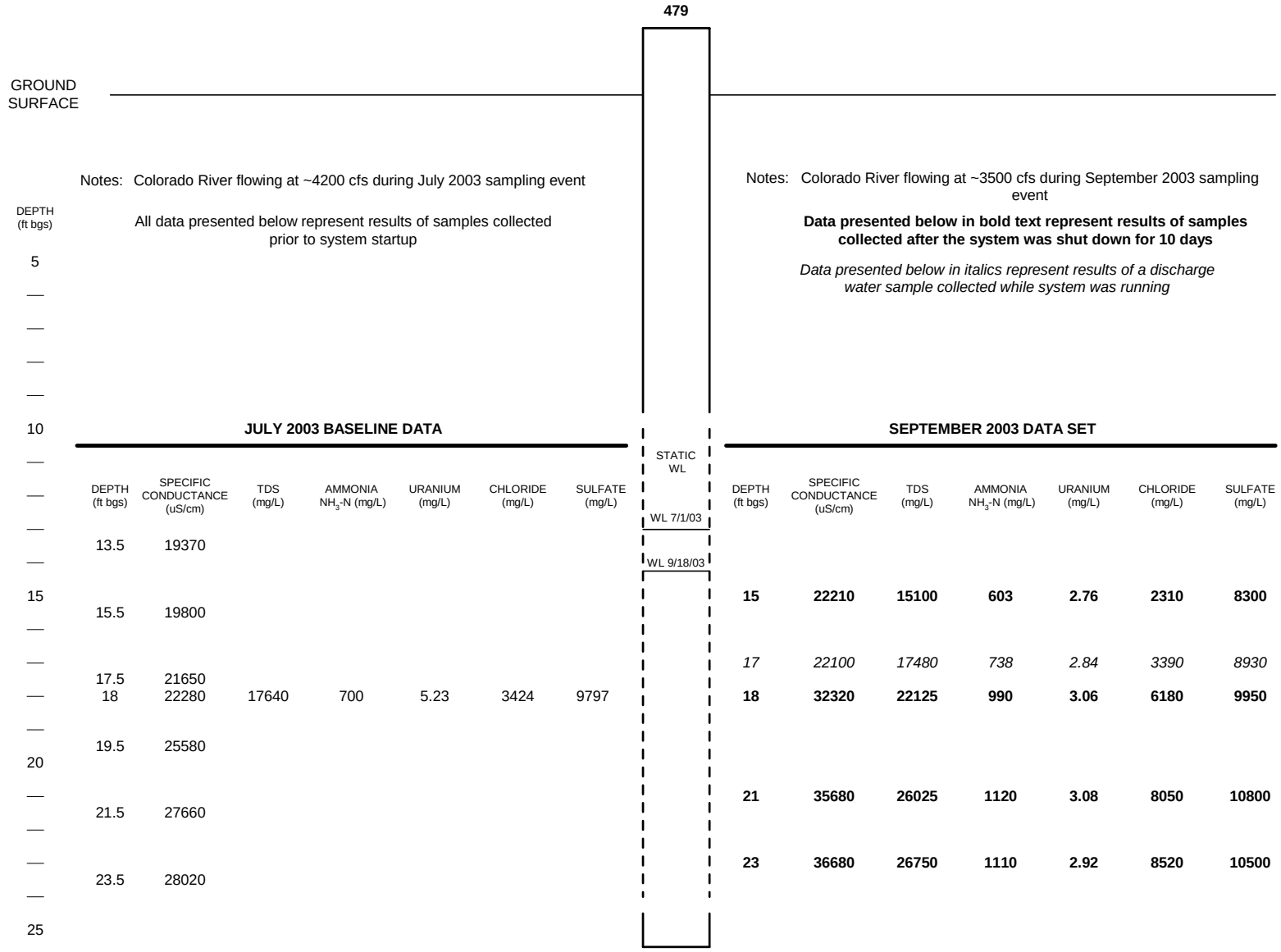


Figure 11. Extraction Well 479 Baseline and September 2003 Ground Water Quality Data

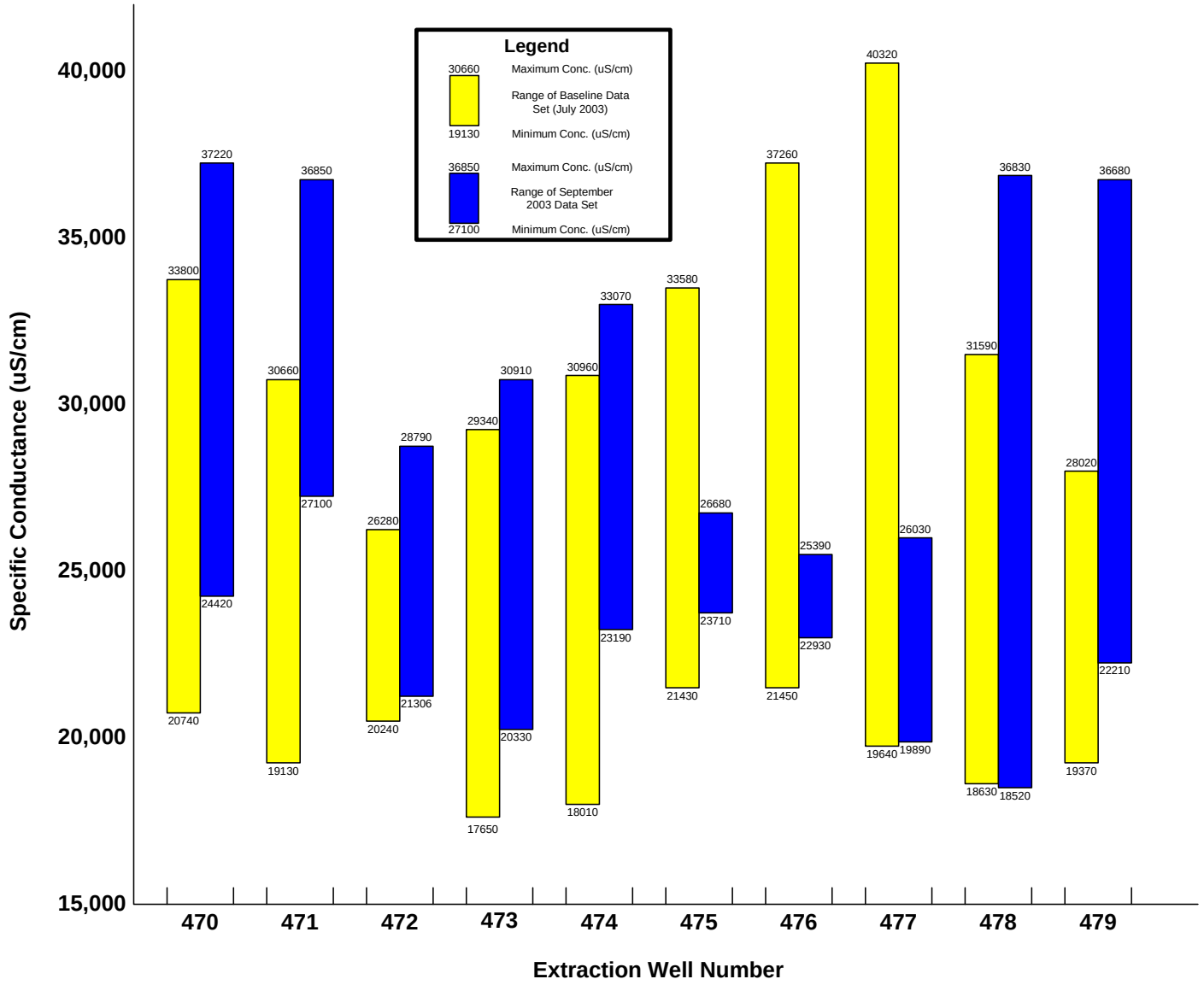


Figure 12. Comparison of Extraction Well Ground Water Baseline and September 2003 Specific Conductance Data

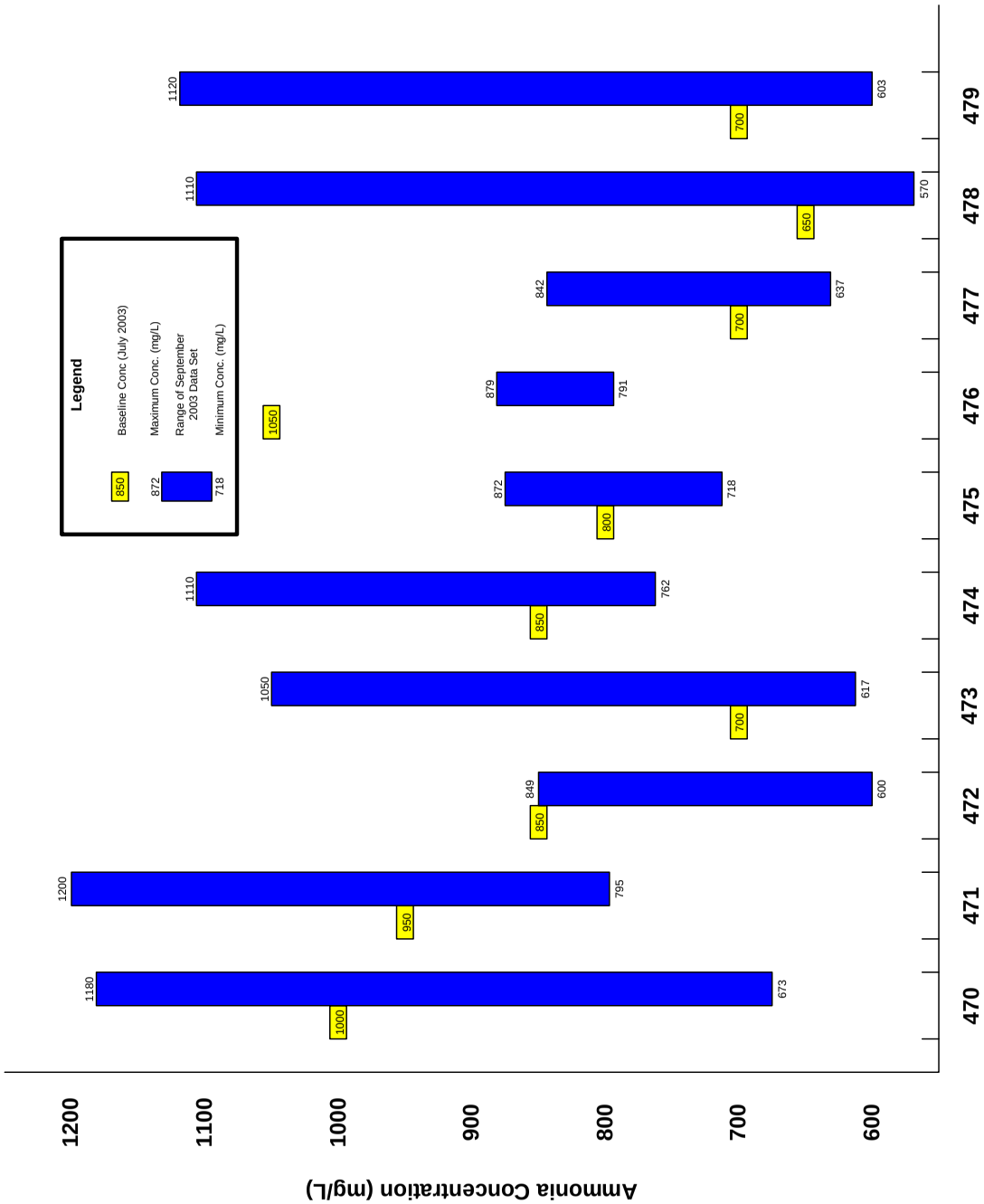


Figure 13. Comparison of Extraction Well Ground Water Baseline and September 2003 Ammonia Concentrations

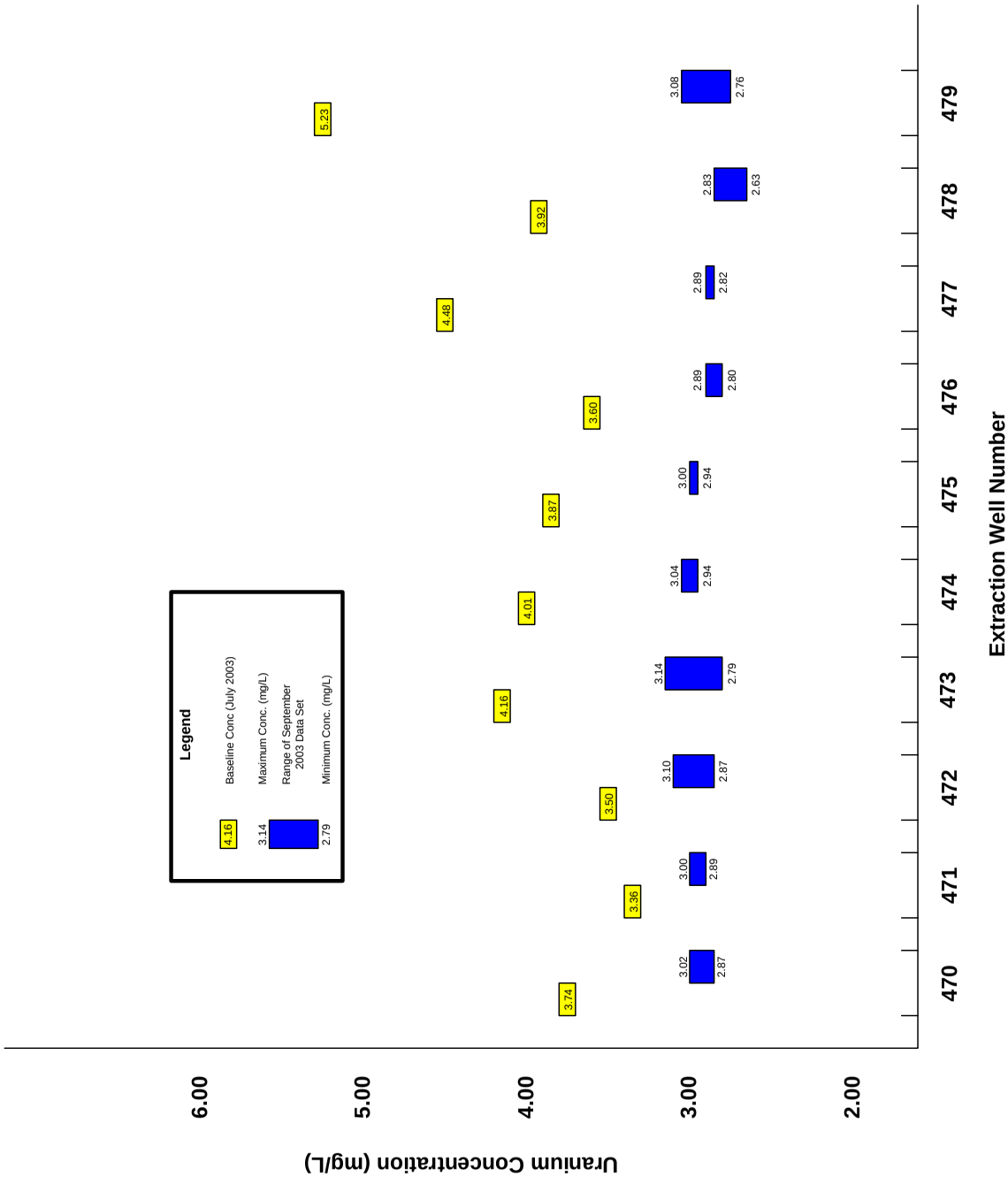


Figure 14. Comparison of Extraction Well Ground Water Baseline and September 2003 Uranium Concentrations

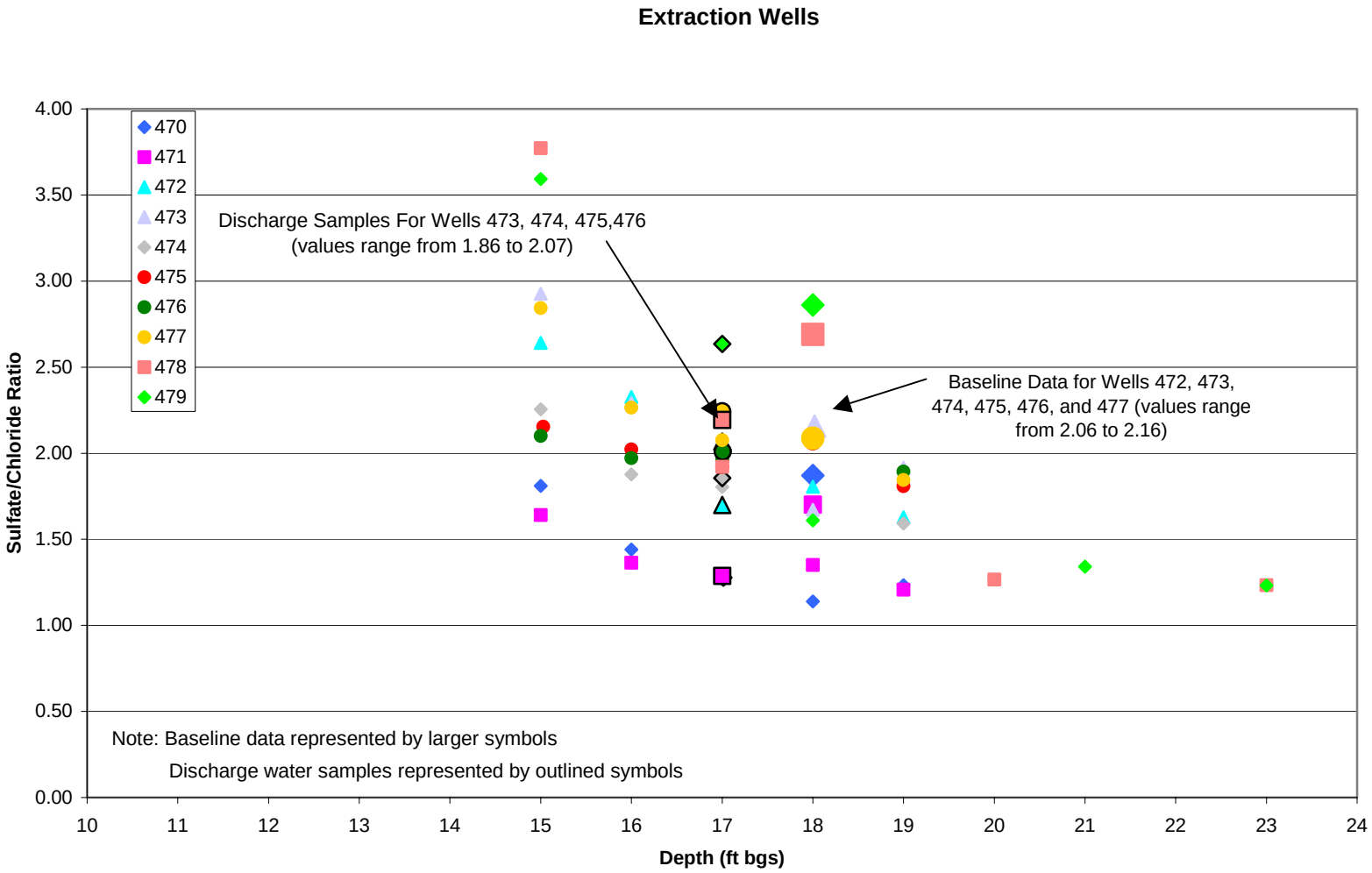
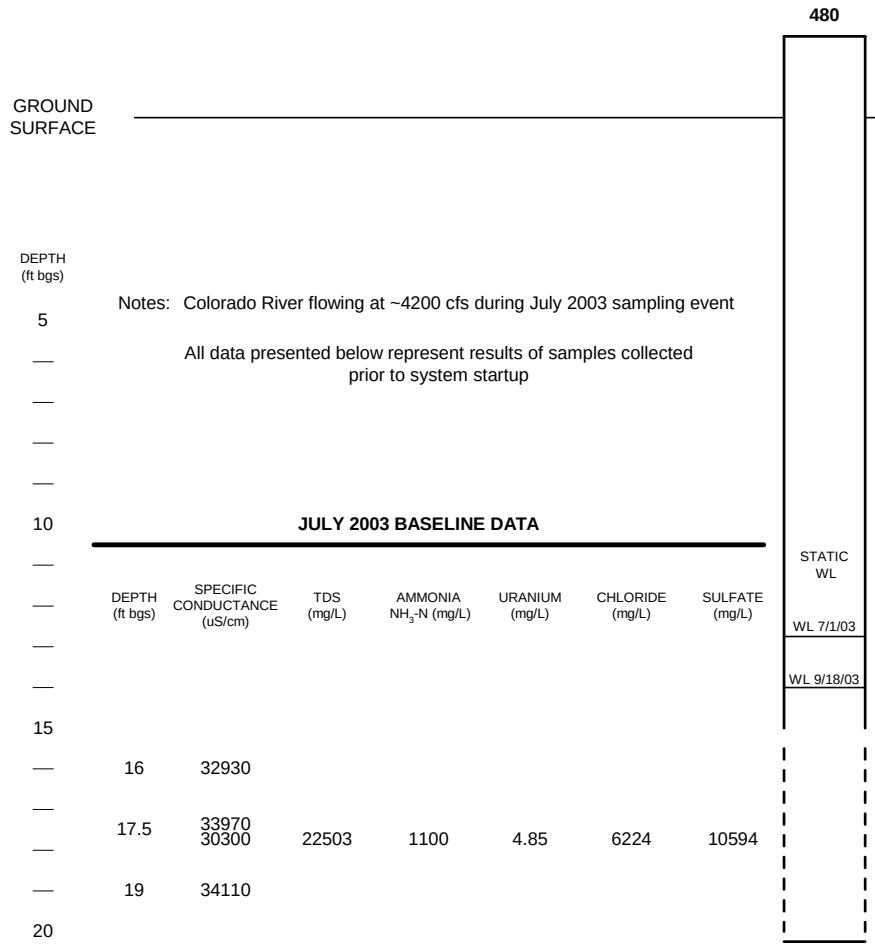


Figure 15. Comparison of Extraction Well Ground Water Baseline and September 2003 Sulfate/Chloride Ratios



Notes: Colorado River flowing at ~4200 cfs during July 2003 sampling event

All data presented below represent results of samples collected prior to system startup

JULY 2003 BASELINE DATA

DEPTH (ft bgs)	SPECIFIC CONDUCTANCE (uS/cm)	TDS (mg/L)	AMMONIA NH_3-N (mg/L)	URANIUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)
16	32930					
17.5	33970 30300	22503	1100	4.85	6224	10594
19	34110					

Notes: Colorado River flowing at ~3500 cfs during September 2003 sampling event

Data presented below in bold text represent results of samples collected after the system was shut down for 10 days

Data presented below in italics represent results of a sample collected while system was running

SEPTEMBER 2003 DATA SET

DEPTH (ft bgs)	SPECIFIC CONDUCTANCE (uS/cm)	TDS (mg/L)	AMMONIA NH_3-N (mg/L)	URANIUM (mg/L)	CHLORIDE (mg/L)	SULFATE (mg/L)
16	**23610**	**19720**	**897**	**3.48**	**3340**	**9810**
18	*33930*	*25825*	*1000*	*3.01*	*7940*	*11200*
19	**35150**	**26450**	**991**	**2.91**	**8000**	**9920**

Figure 16. Observation Well 480 Baseline and September 2003 Ground Water Quality Data

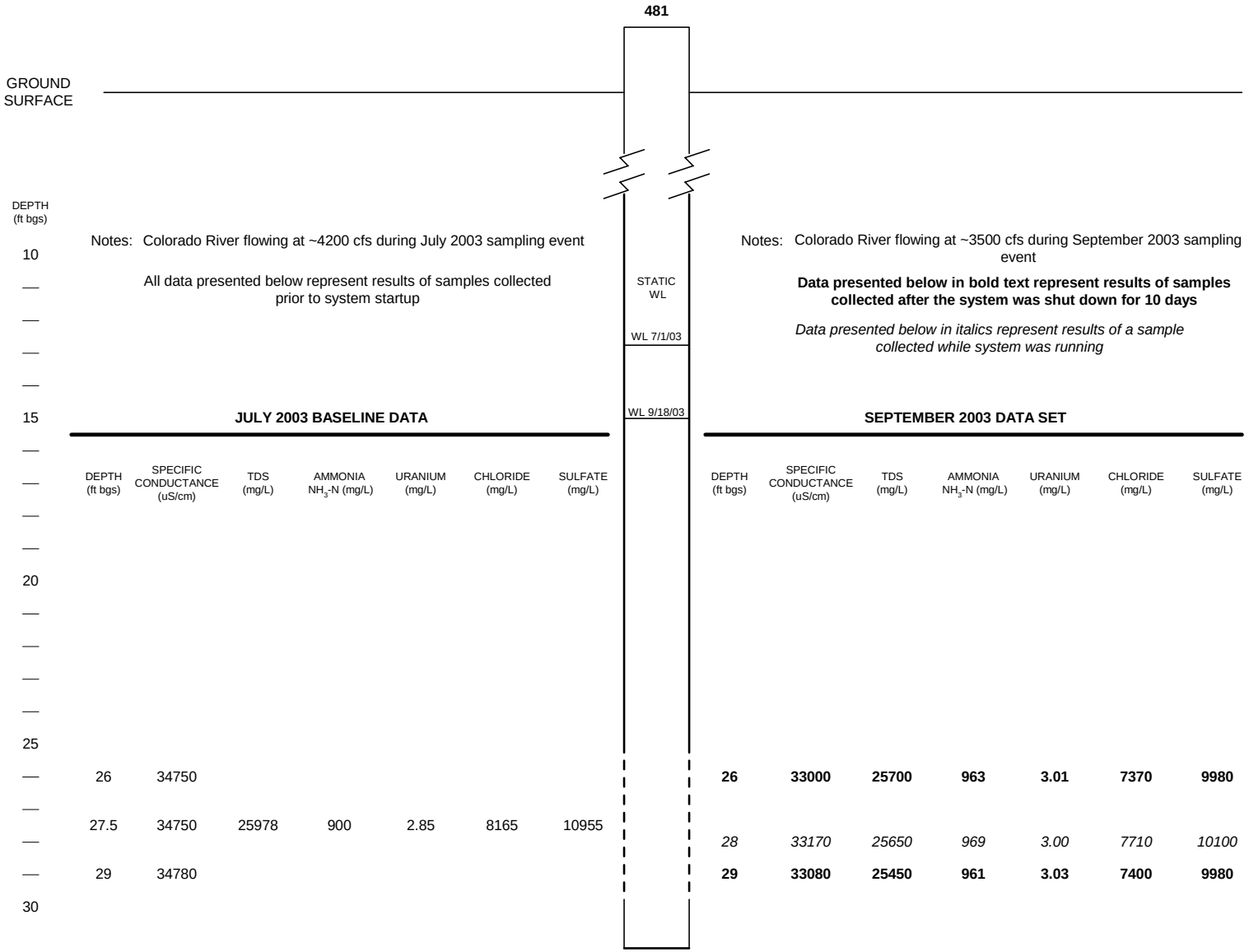


Figure 17. Observation Well 481 Baseline and September 2003 Ground Water Quality Data

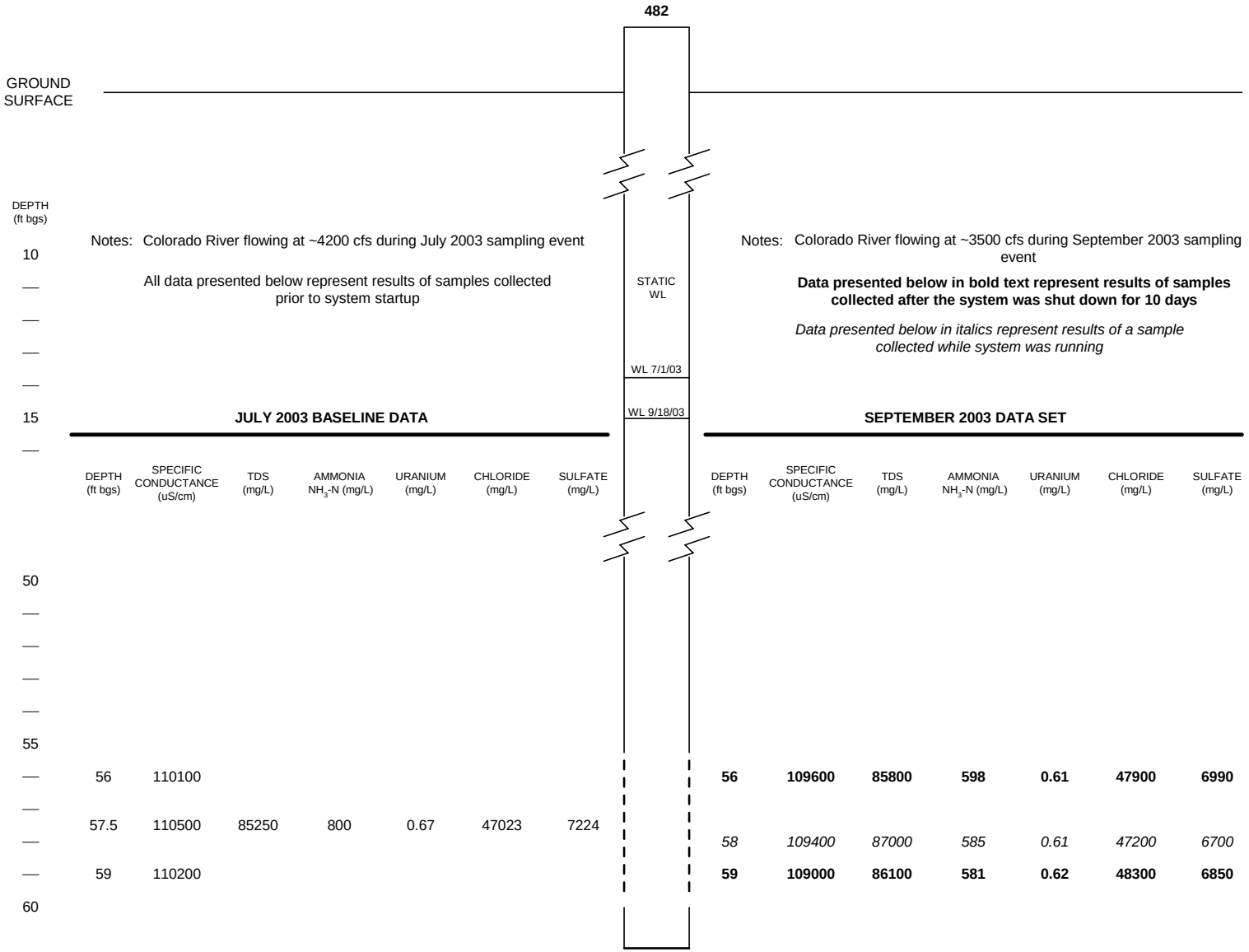


Figure 18. Observation Well 482 Baseline and September 2003 Ground Water Quality Data

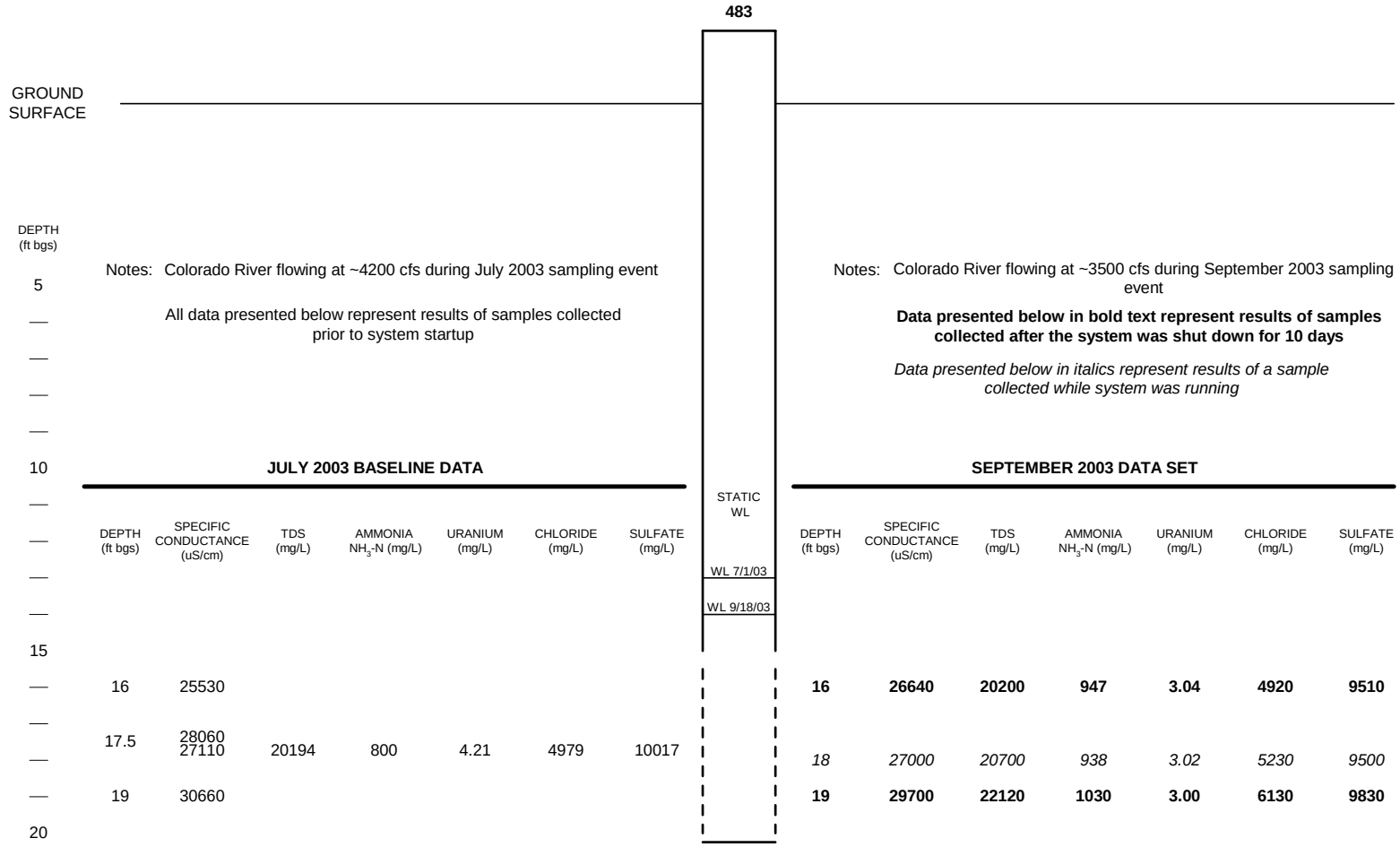


Figure 19. Observation Well 483 Baseline and September 2003 Ground Water Quality Data

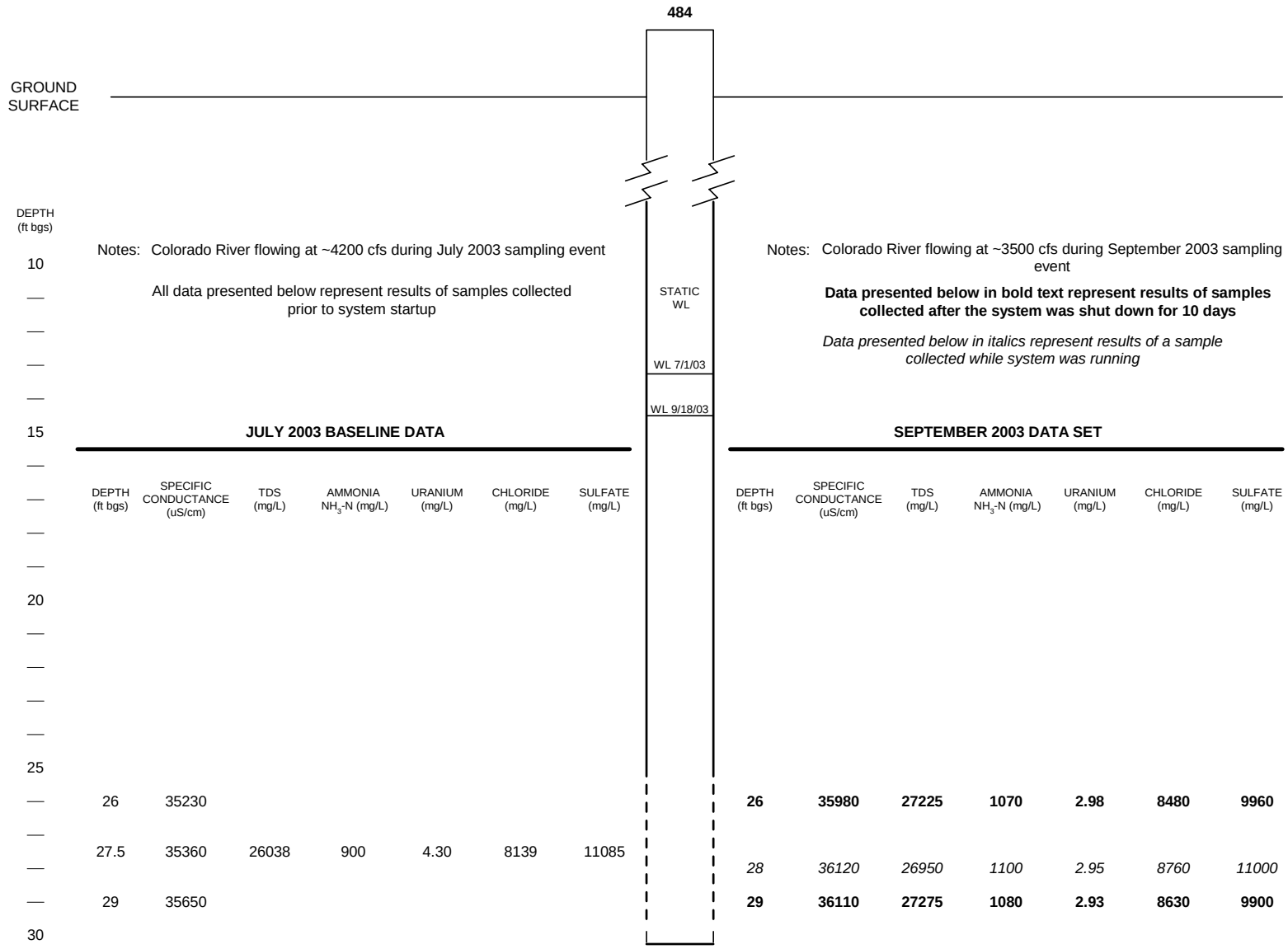


Figure 20. Observation Well 484 Baseline and September 2003 Ground Water Quality Data

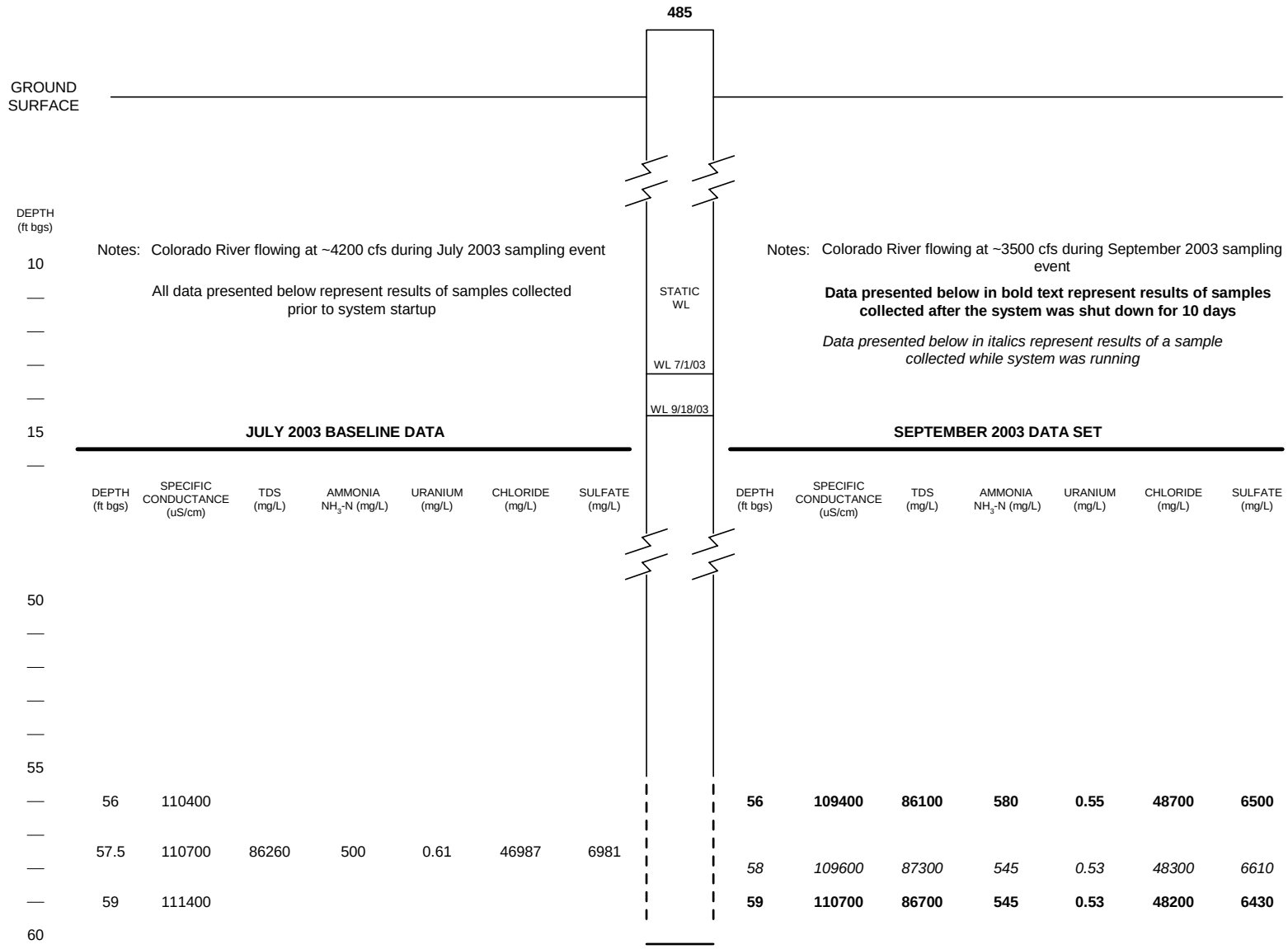


Figure 21. Observation Well 485 Baseline and September 2003 Ground Water Quality Data

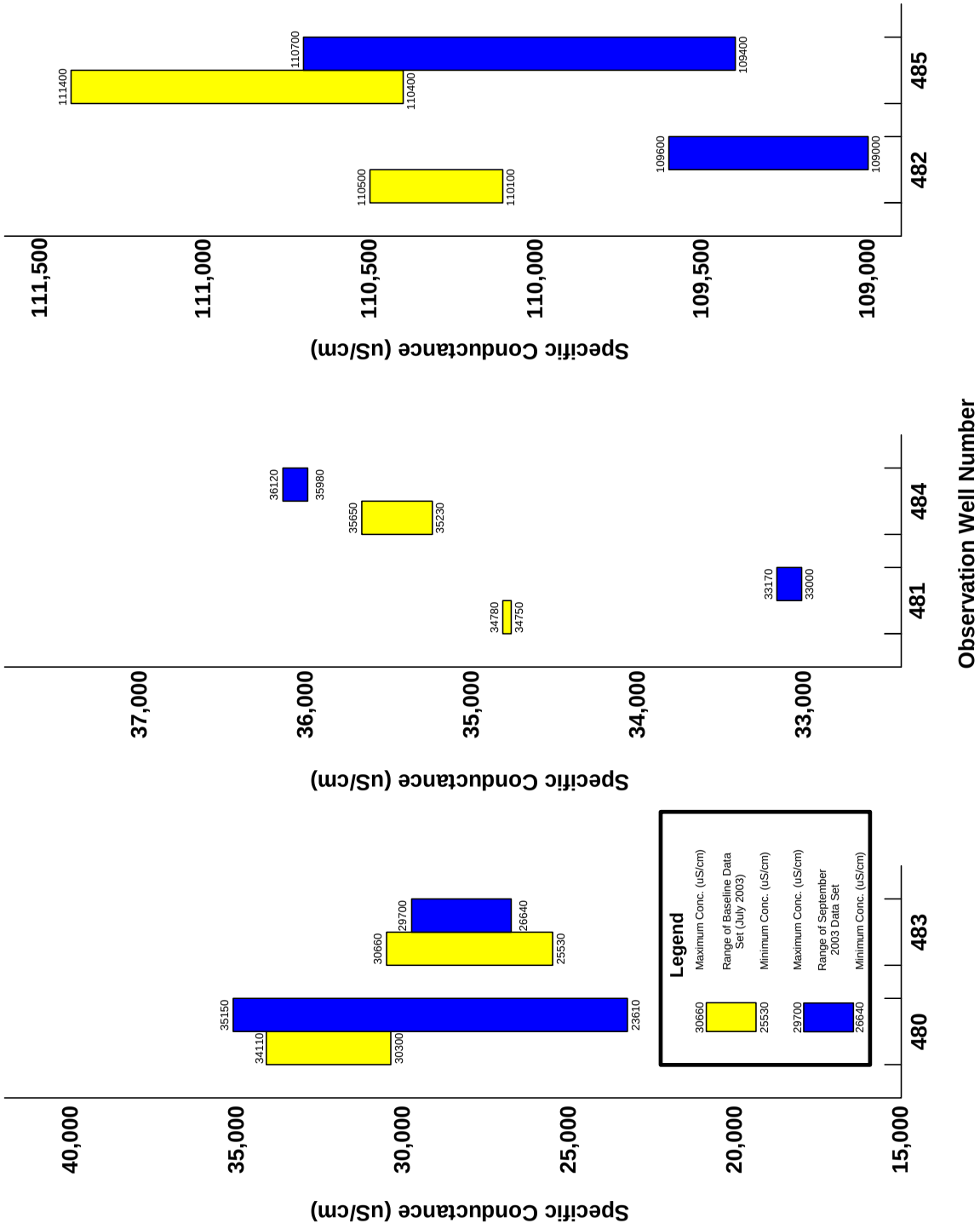


Figure 22. Comparison of Observation Well Ground Water Baseline and September 2003 Specific Conductance Data

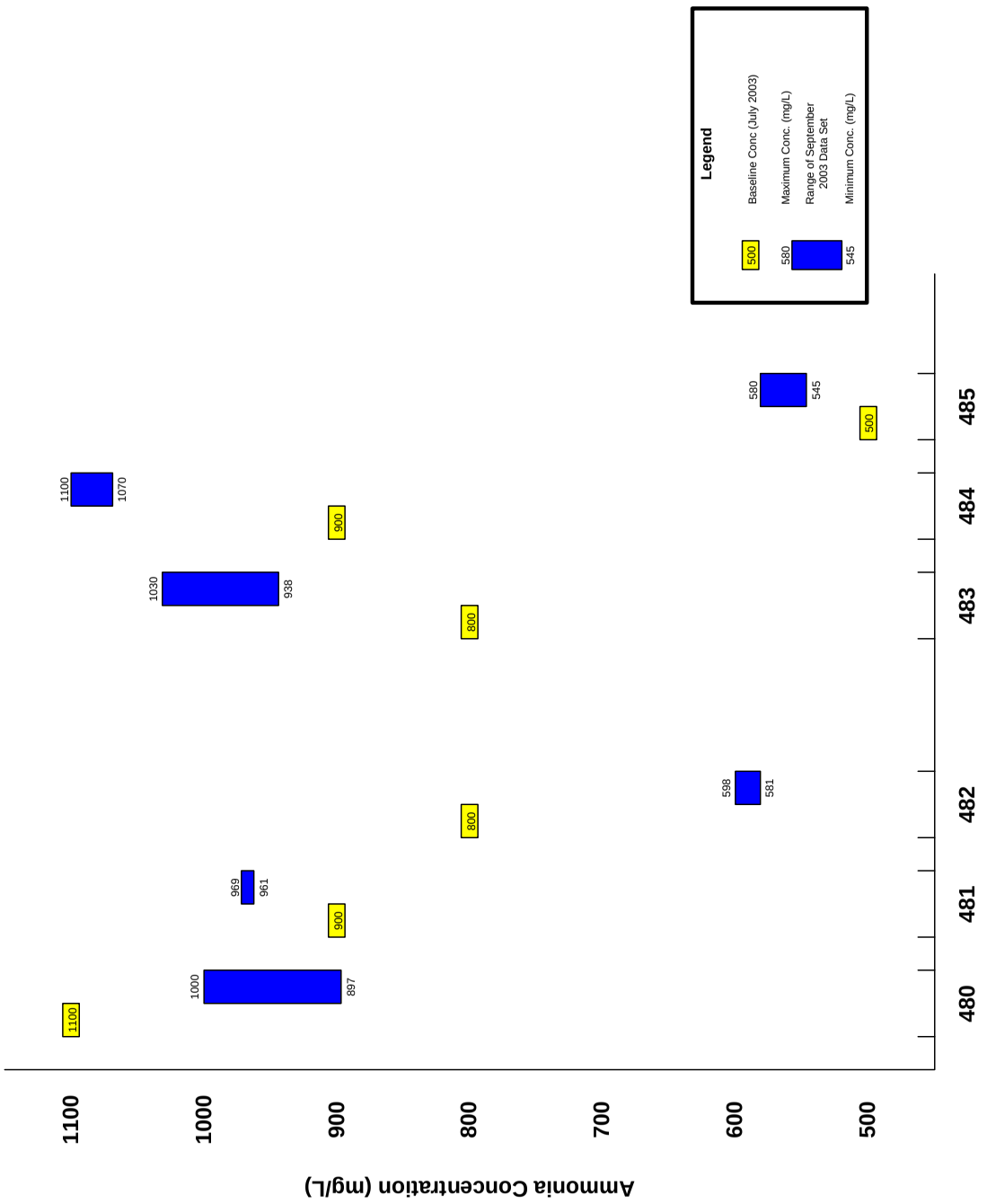


Figure 23. Comparison of Observation Well Ground Water Baseline and September 2003 Ammonia Concentrations

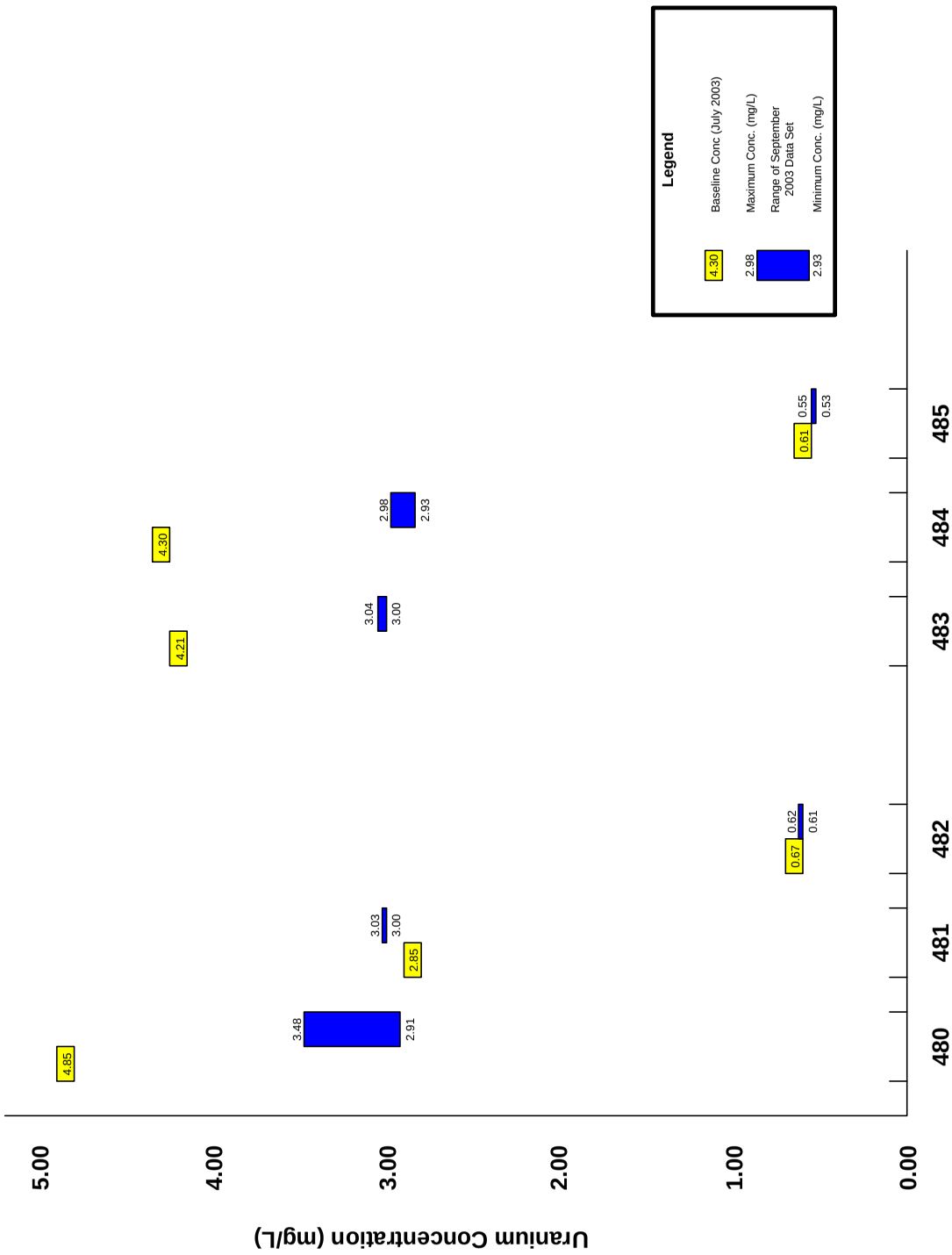


Figure 24. Comparison of Observation Well Ground Water Baseline and September 2003 Uranium Concentrations

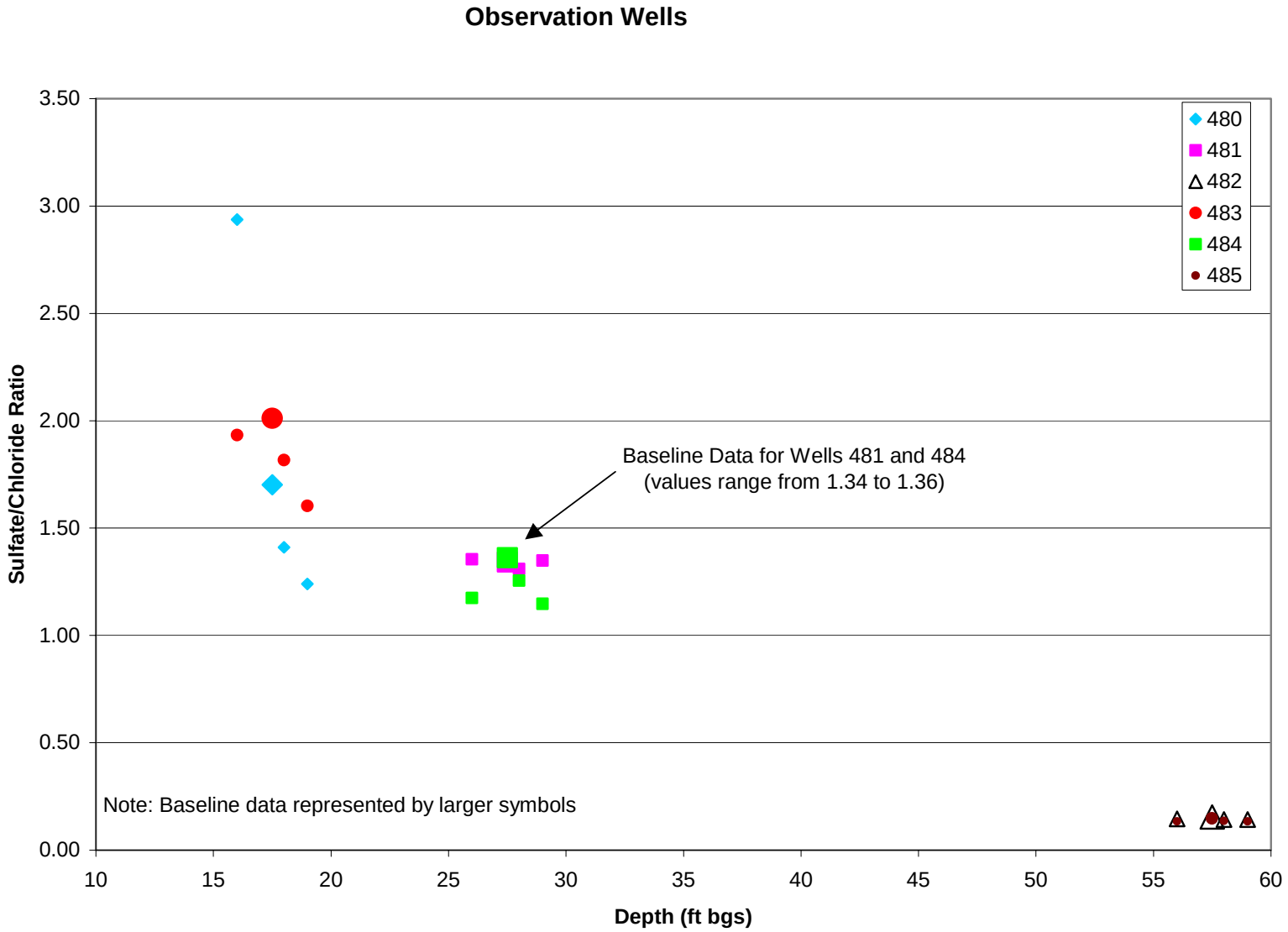


Figure 25. Comparison of Observation Well Ground Water Baseline and September 2003 Sulfate/Chloride Ratios

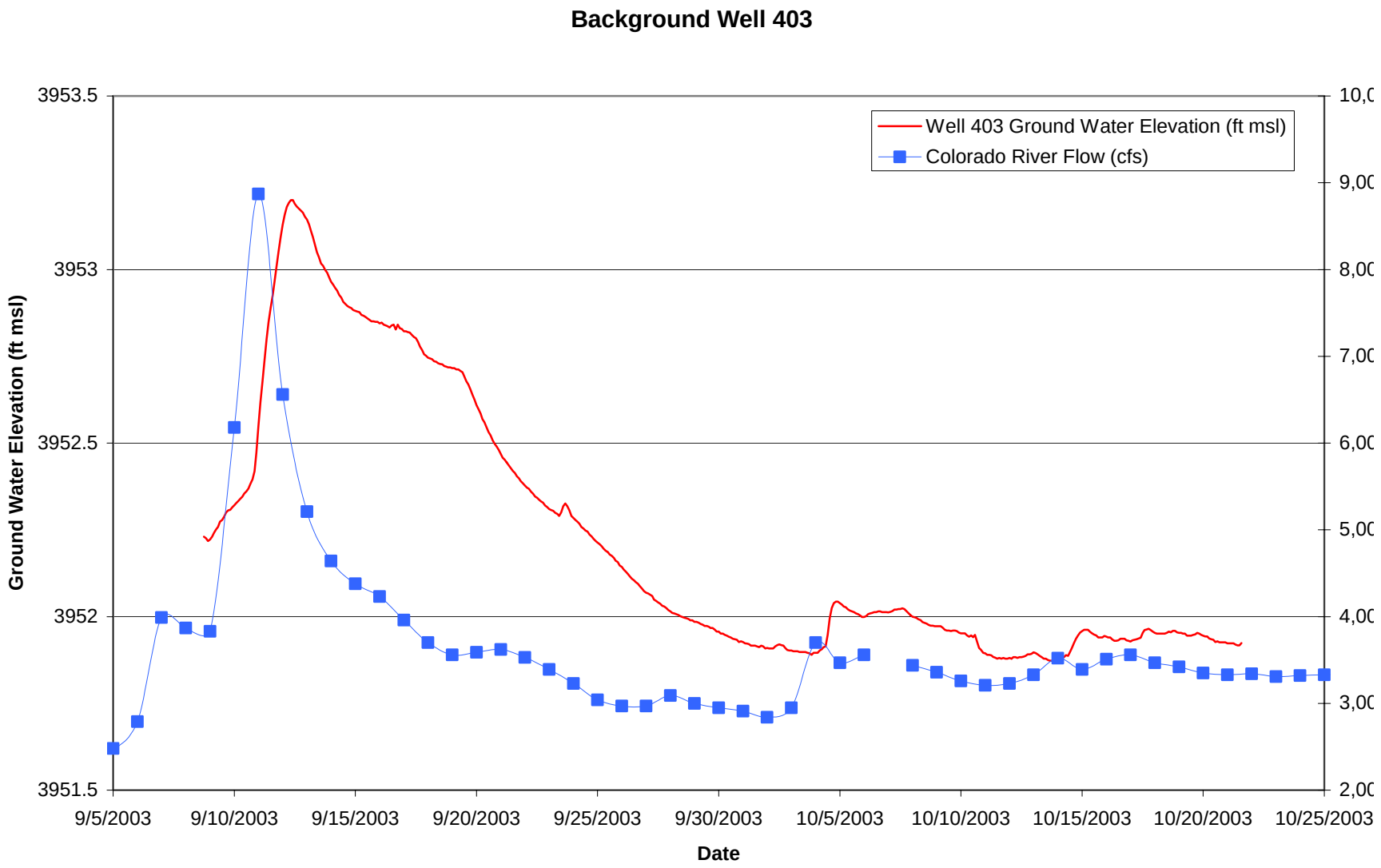


Figure 26. Background Well 403 Ground Water Elevations, September through October 2003

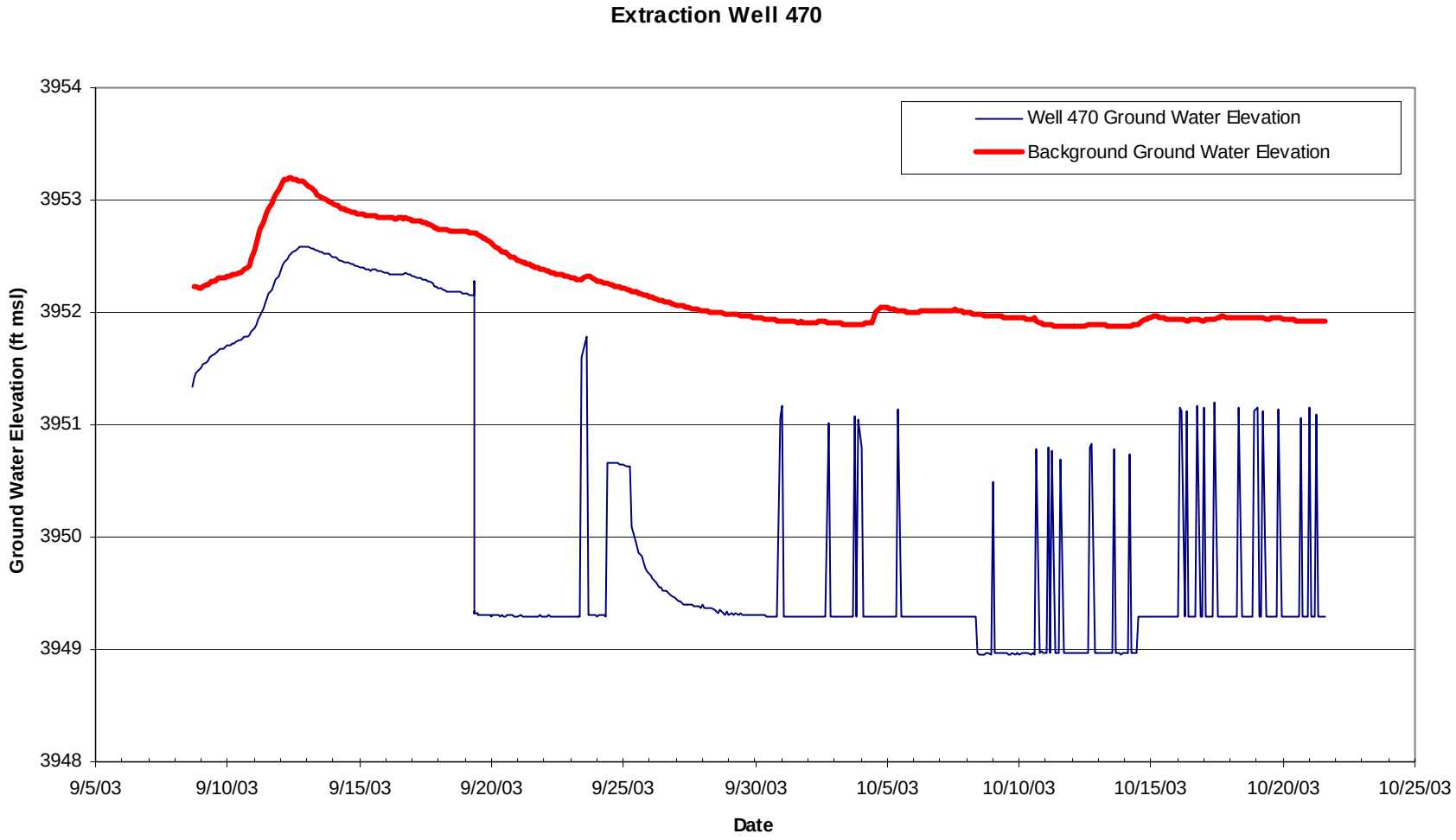


Figure 27. Extraction Well 470 Ground Water Elevations, September through October 2003

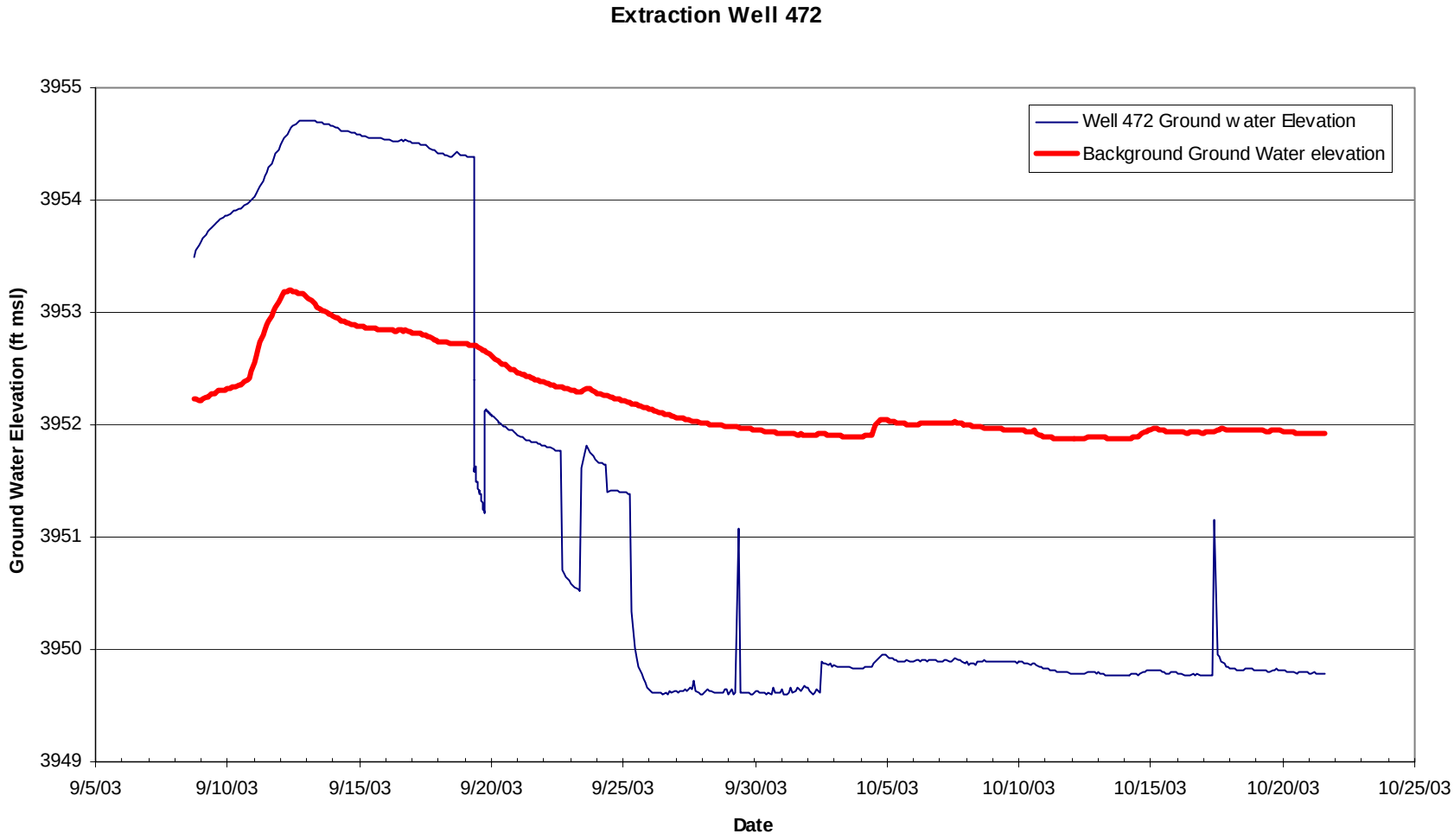


Figure 28. Extraction Well 472 Ground Water Elevations, September through October 2003

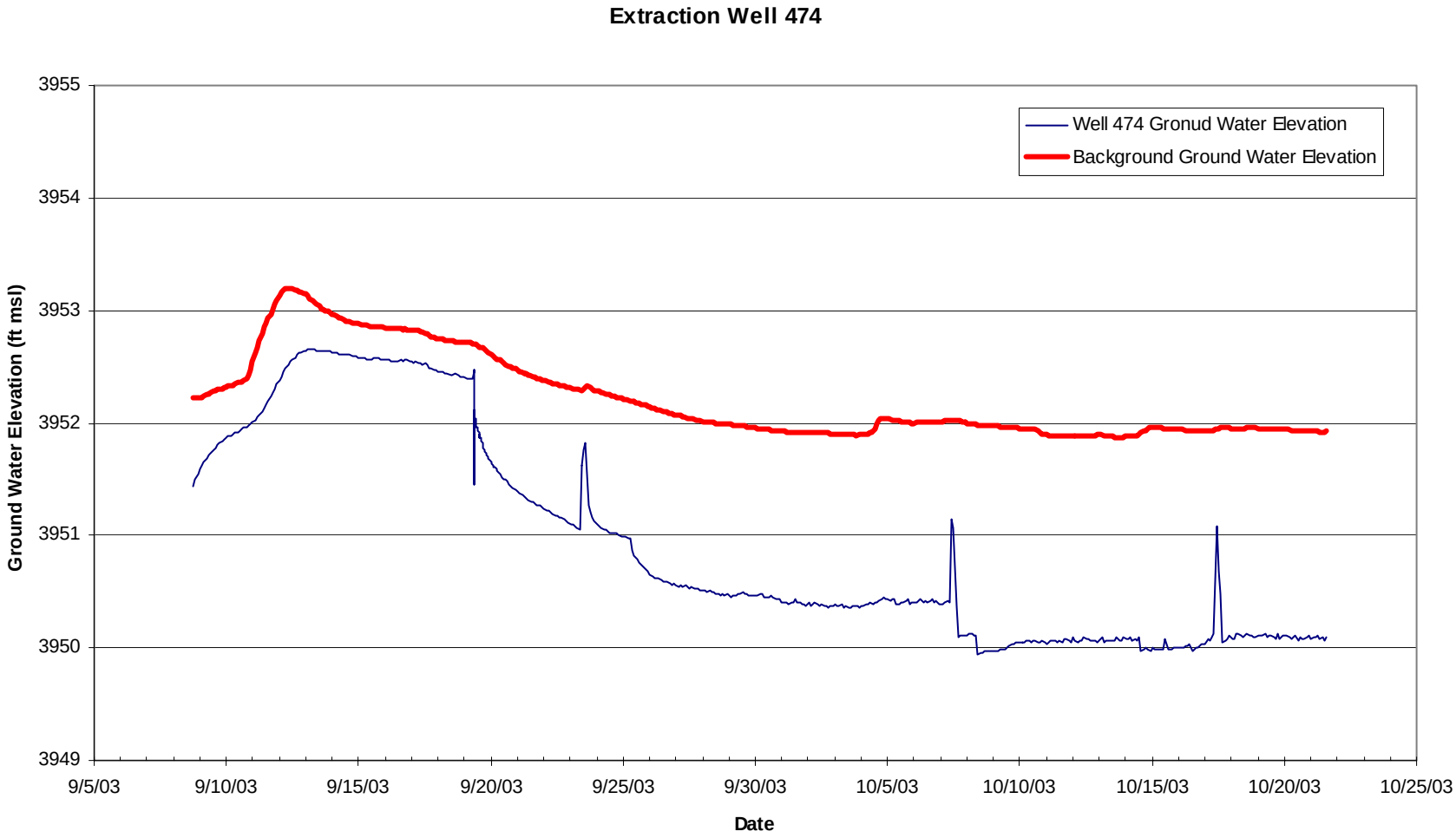


Figure 29. Extraction Well 474 Ground Water Elevations, September through October 2003

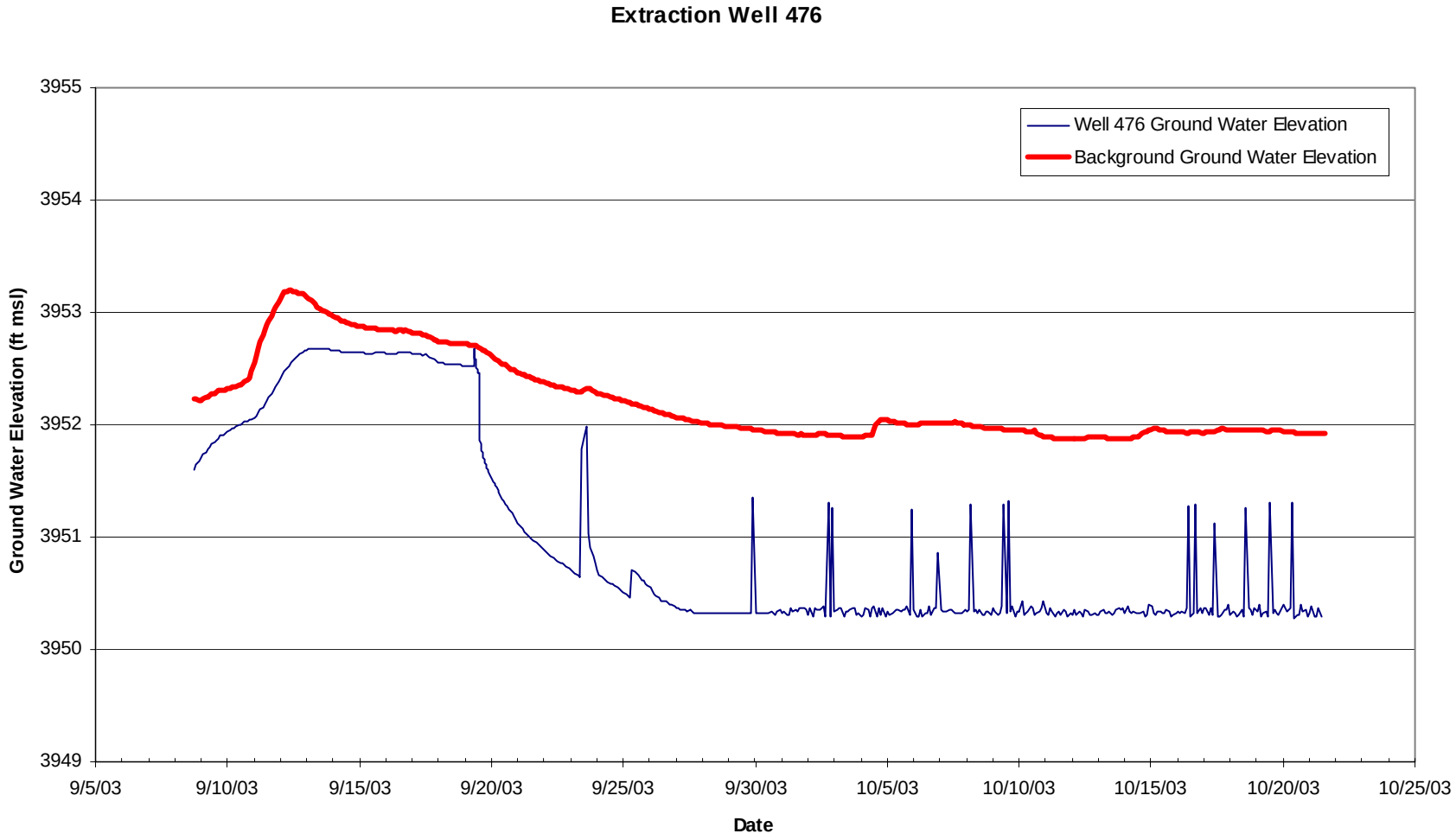


Figure 30. Extraction Well 476 Ground Water Elevations, September through October 2003

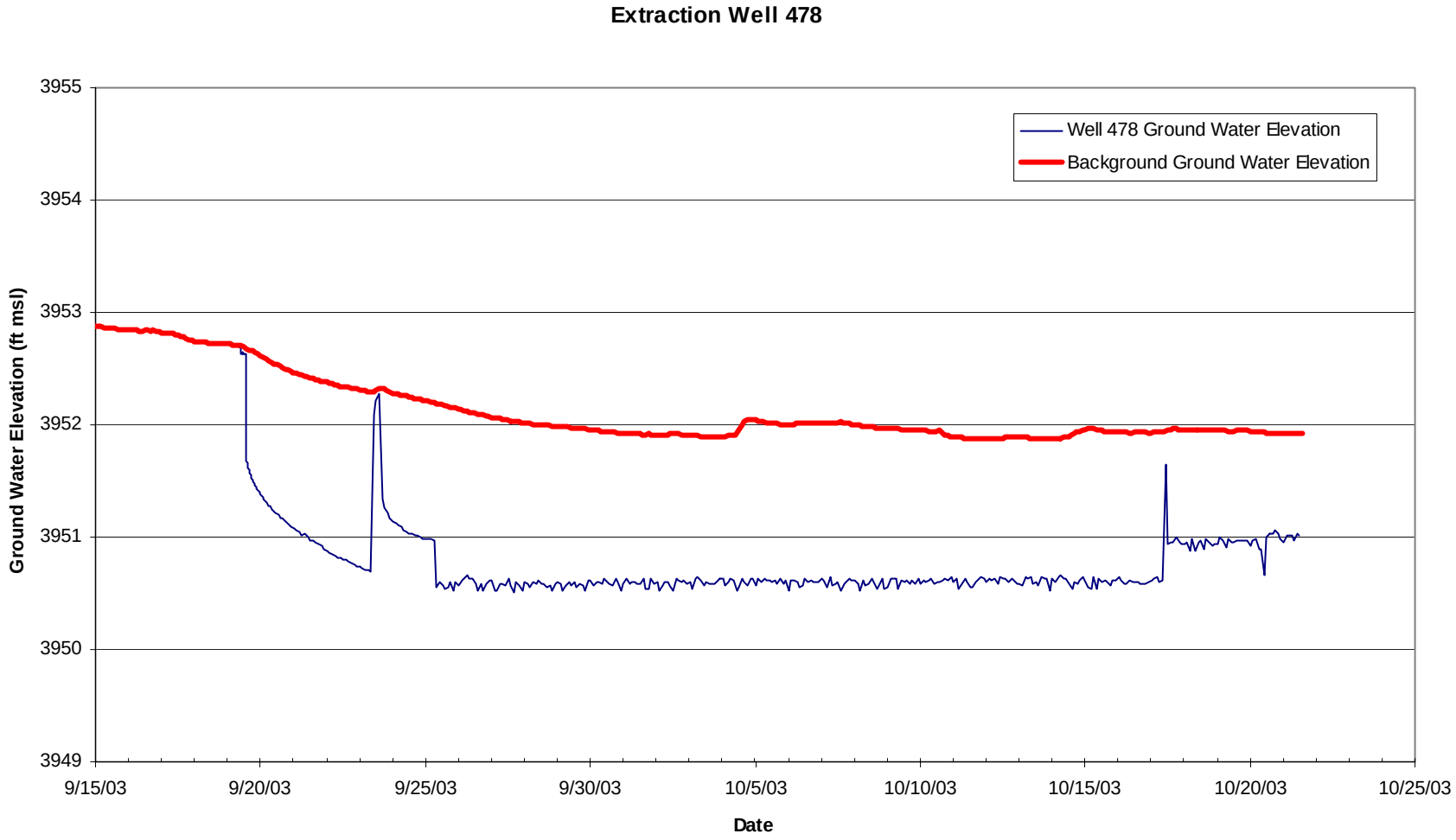


Figure 31. Extraction Well 478 Ground Water Elevations, September through October 2003

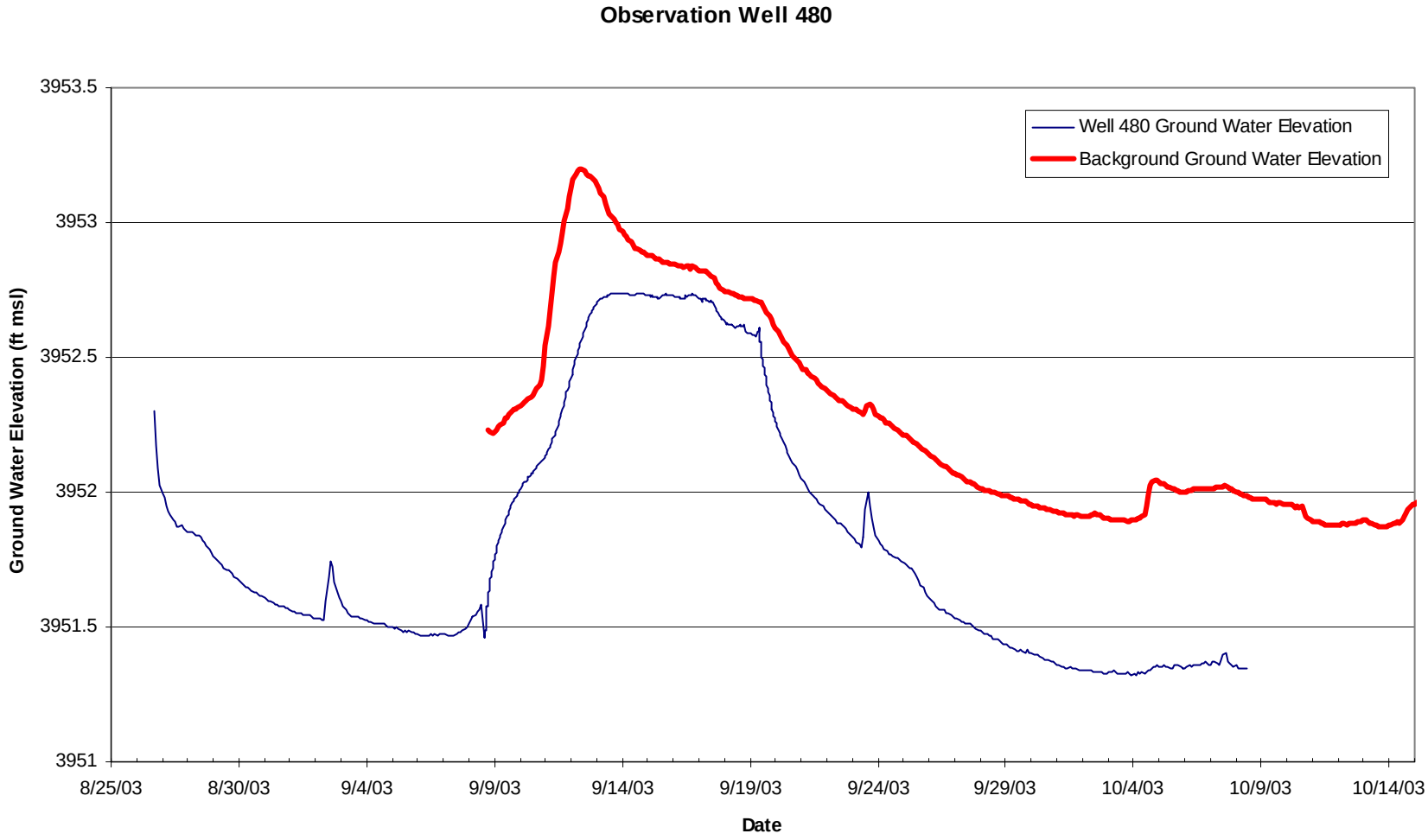


Figure 32. Observation Well 480 Ground Water Elevations, September through October 2003

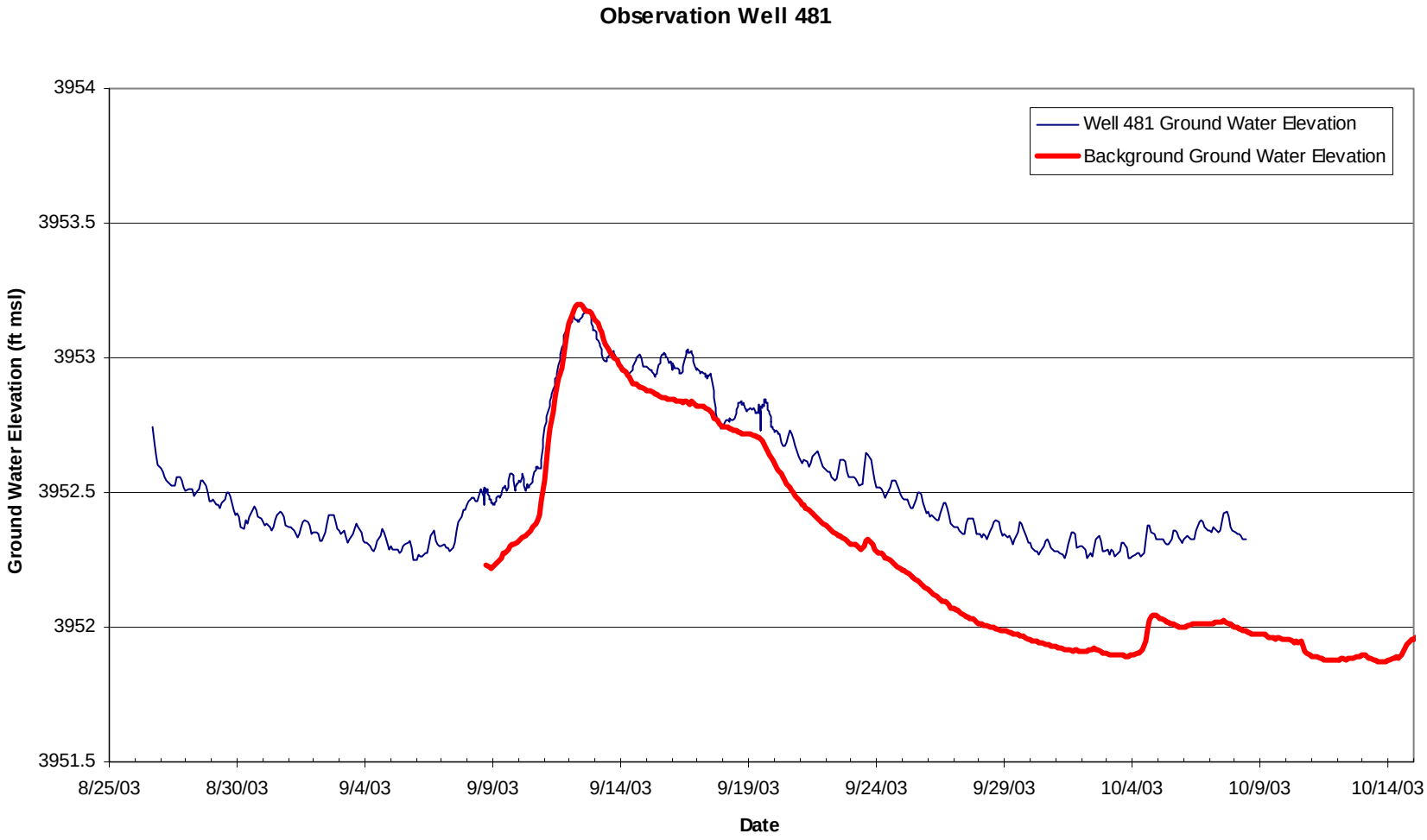


Figure 33. Observation Well 481 Ground Water Elevations, September through October 2003

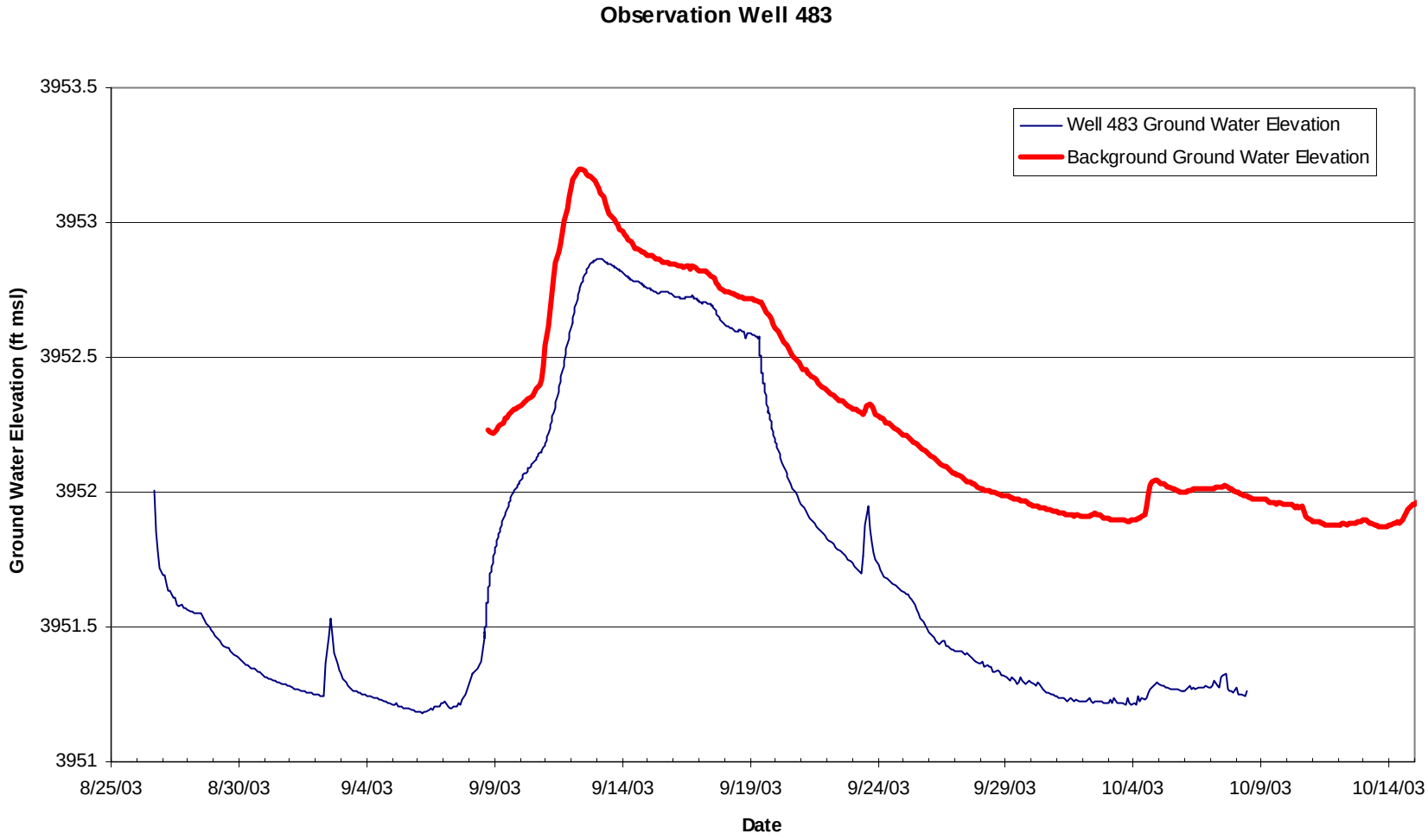


Figure 34. Observation Well 483 Ground Water Elevations, September through October 2003

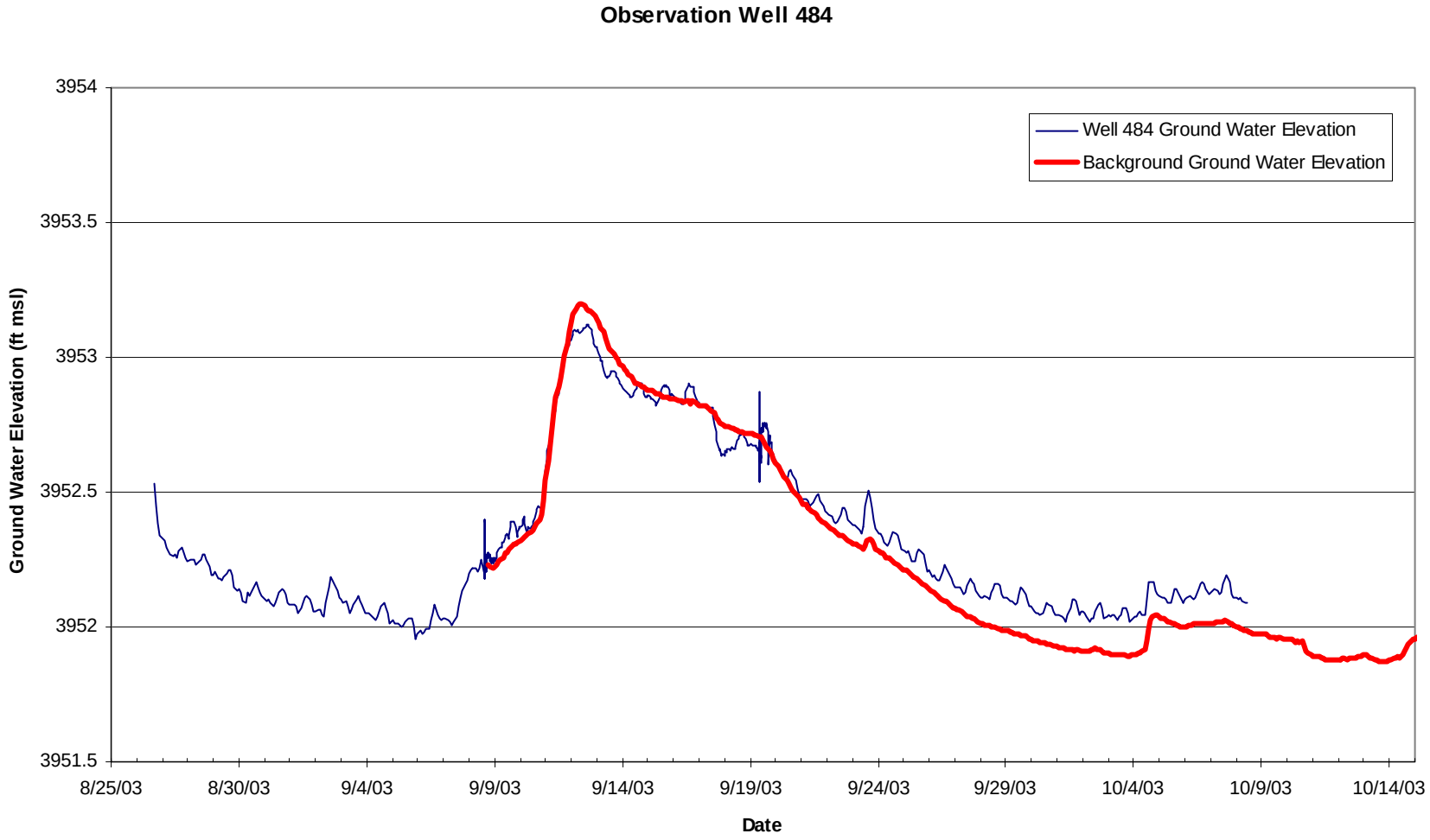


Figure 35. Observation Well 484 Ground Water Elevations, September through October 2003

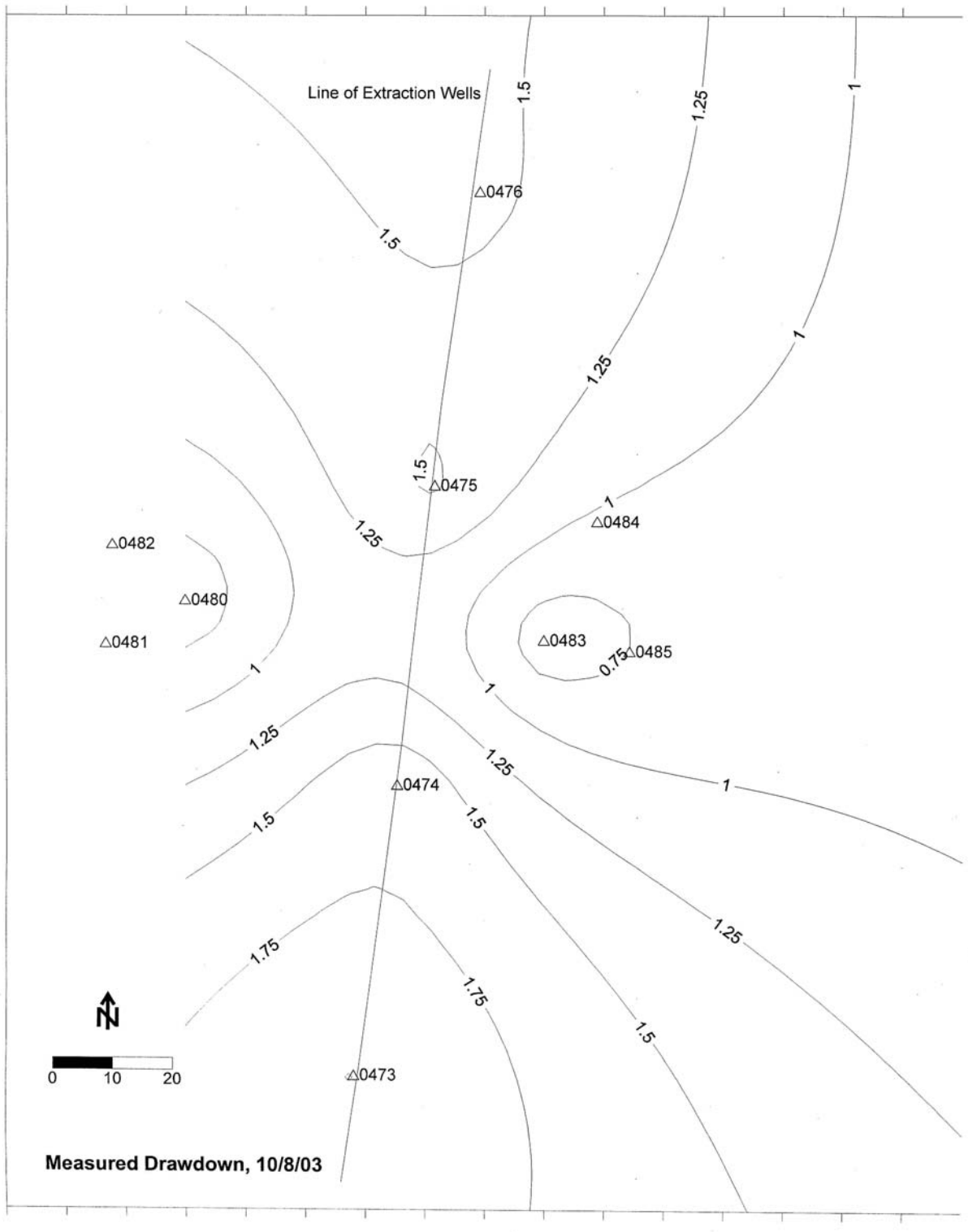


Figure 36. Drawdown Measured in the Center of the Extraction Well Field, October 8, 2003

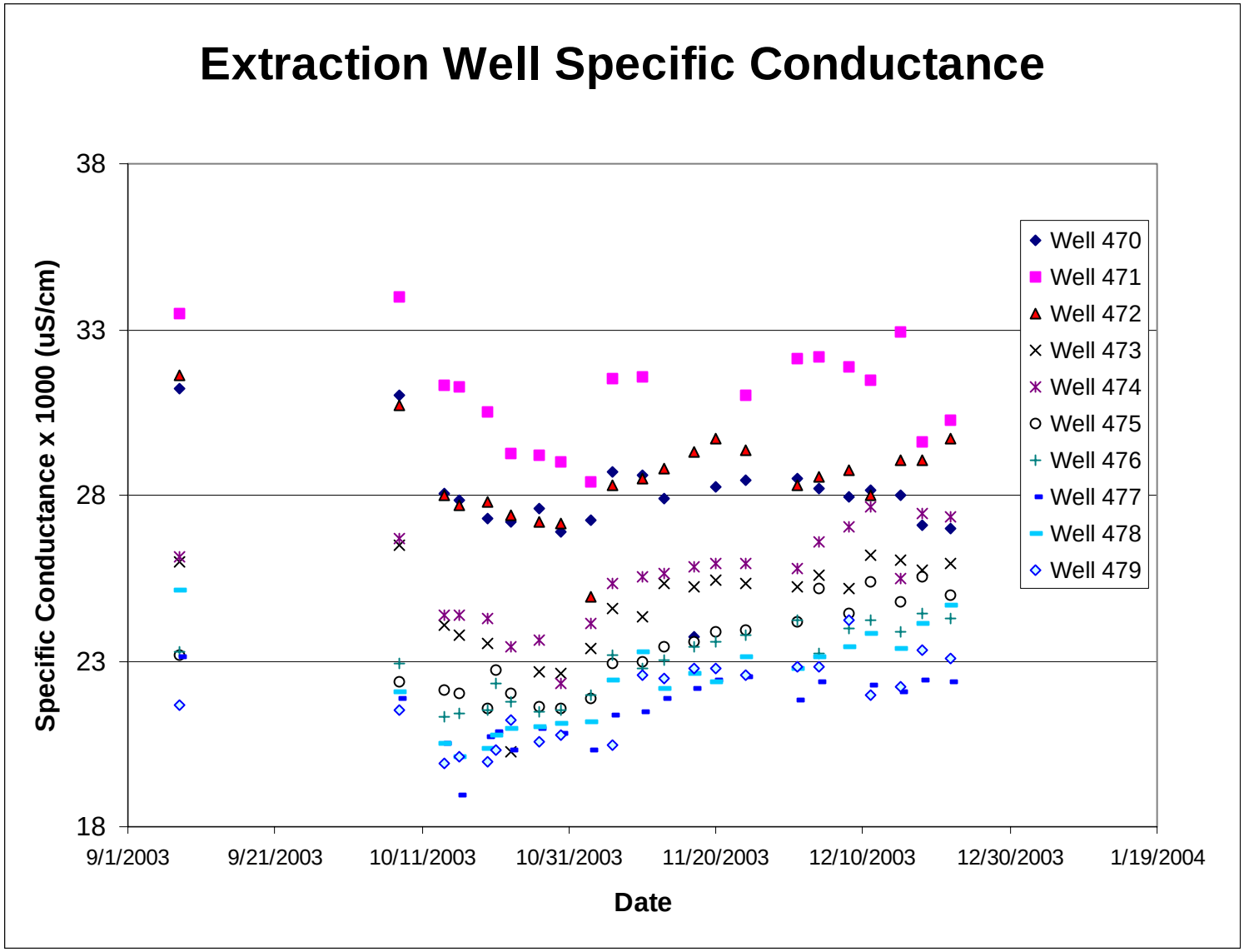


Figure 37. Extraction Well Discharge Water Specific Conductance Vs. Time

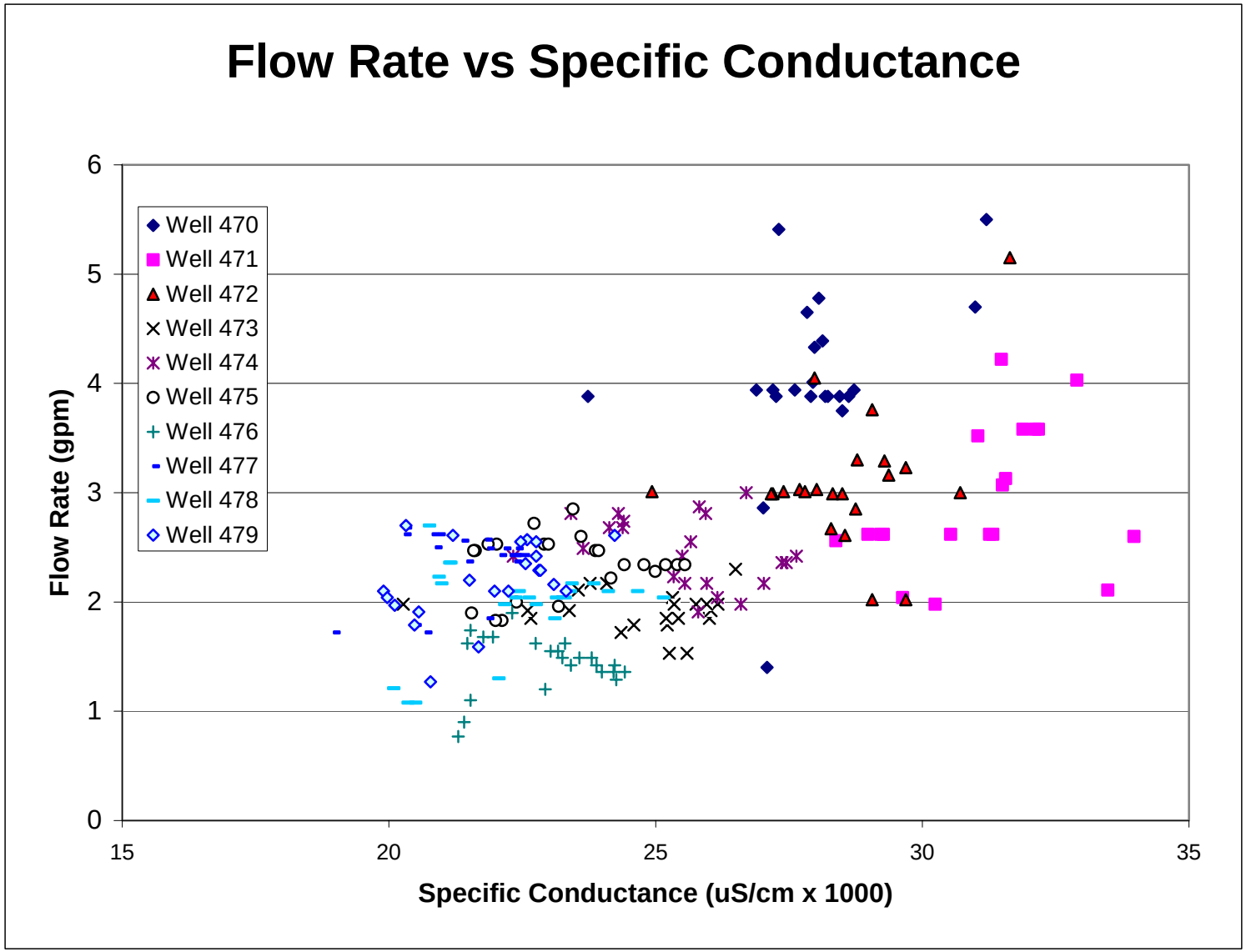


Figure 38. Extraction Well Discharge Water Specific Conductance Vs. Flow Rate

Appendix A

Water Level and Discharge Water Parameter Data From System Shutdown and Restart

A1.0

Data Collected During the September 8, 2003, System Shutdown

Extraction Well Field Discharge Water Field Parameter and Water Level Data Collected During the September 8, 2003 Sytem Shutdown

	Prior to System Shutdown				Wells 471, 473, 476, and 478 Offline[a]				System Shutdown[b]			
Well	DTW (ft btoc)	Temp (^{o}C)	Spec Cond (uS/cm)	pH	DTW (ft btoc)	Temp (^{o}C)	Spec Cond (uS/cm)	pH	DTW (ft btoc)	Temp (^{o}C)	Spec Cond (uS/cm)	pH
470	19.05	16.4	31,200	6.91	19.15	16.4	31,230	6.89	17.10	no data - well offline		
471	18.00	16.8	33,480	6.82	17.31	no data - well offline			17.27	no data - well offline		
472	19.00	16.5	31,640	6.82	18.65	17.3	30,430	6.81	17.37	no data - well offline		
473	19.00	17.3	26,010	6.82	17.48	no data - well offline			17.43	no data - well offline		
474	18.40	17.5	26,160	6.83	18.40	18.7	26,550	6.83	17.82	no data - well offline		
475	18.95	17.9	23,180	6.83	18.95	nd	23,770	nd	17.85	no data - well offline		
476	19.00	19.7	23,300	6.91	17.87	no data - well offline			17.85	no data - well offline		
477	18.90	17.9	23,150	6.87	18.74	nd	22,290	6.85	17.65	no data - well offline		
478	18.95	17.9	25,150	6.87	17.62	no data - well offline			17.61	no data - well offline		
479	18.40	17.5	21,680	6.86	18.09	nd	21,550	6.87	17.20	no data - well offline		
480	17.18	nd	nd	nd	17.18	nd	nd	nd	nd	nd	nd	nd
481	16.35	nd	nd	nd	16.35	nd	nd	nd	nd	nd	nd	nd
482	17.03	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd
483	17.46	nd	nd	nd	17.45	nd	nd	nd	nd	nd	nd	nd
484	17.00	nd	nd	nd	16.98	nd	nd	nd	nd	nd	nd	nd
485	16.65	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd	nd

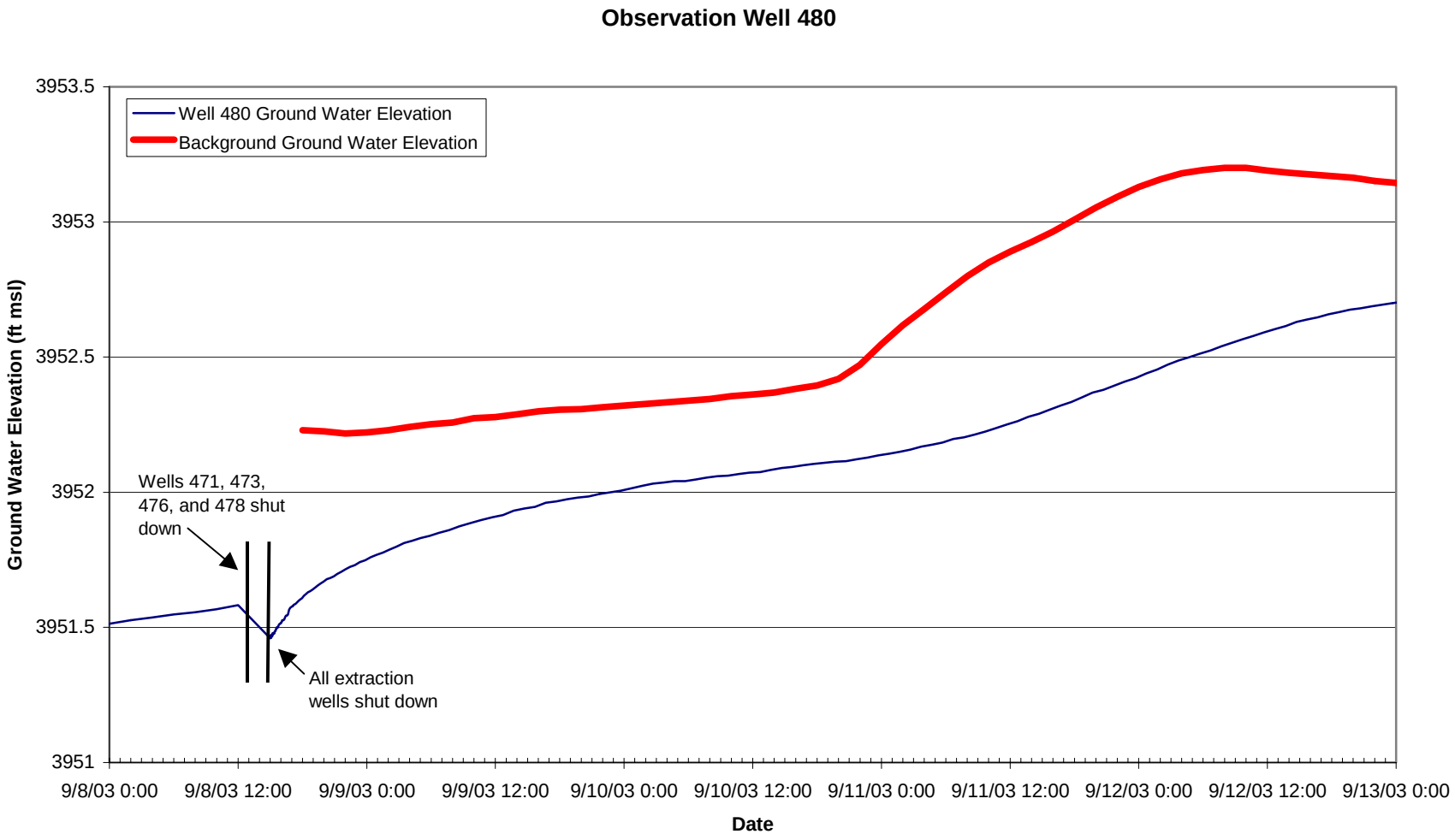
Notes: DTW = Depth to Water (ft below top of casing)

Spec Cond = Specific Conductivity

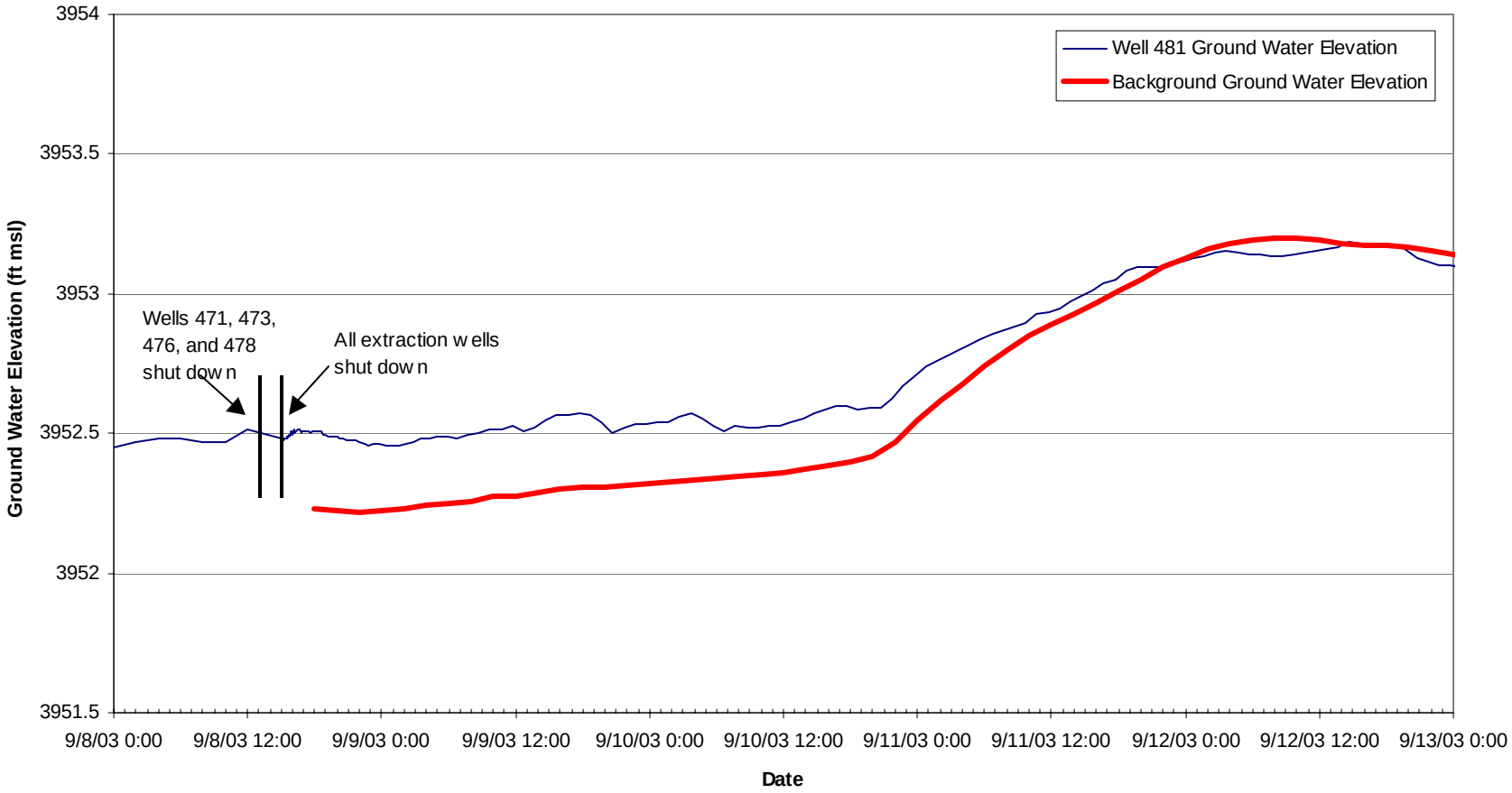
nd = no data collected

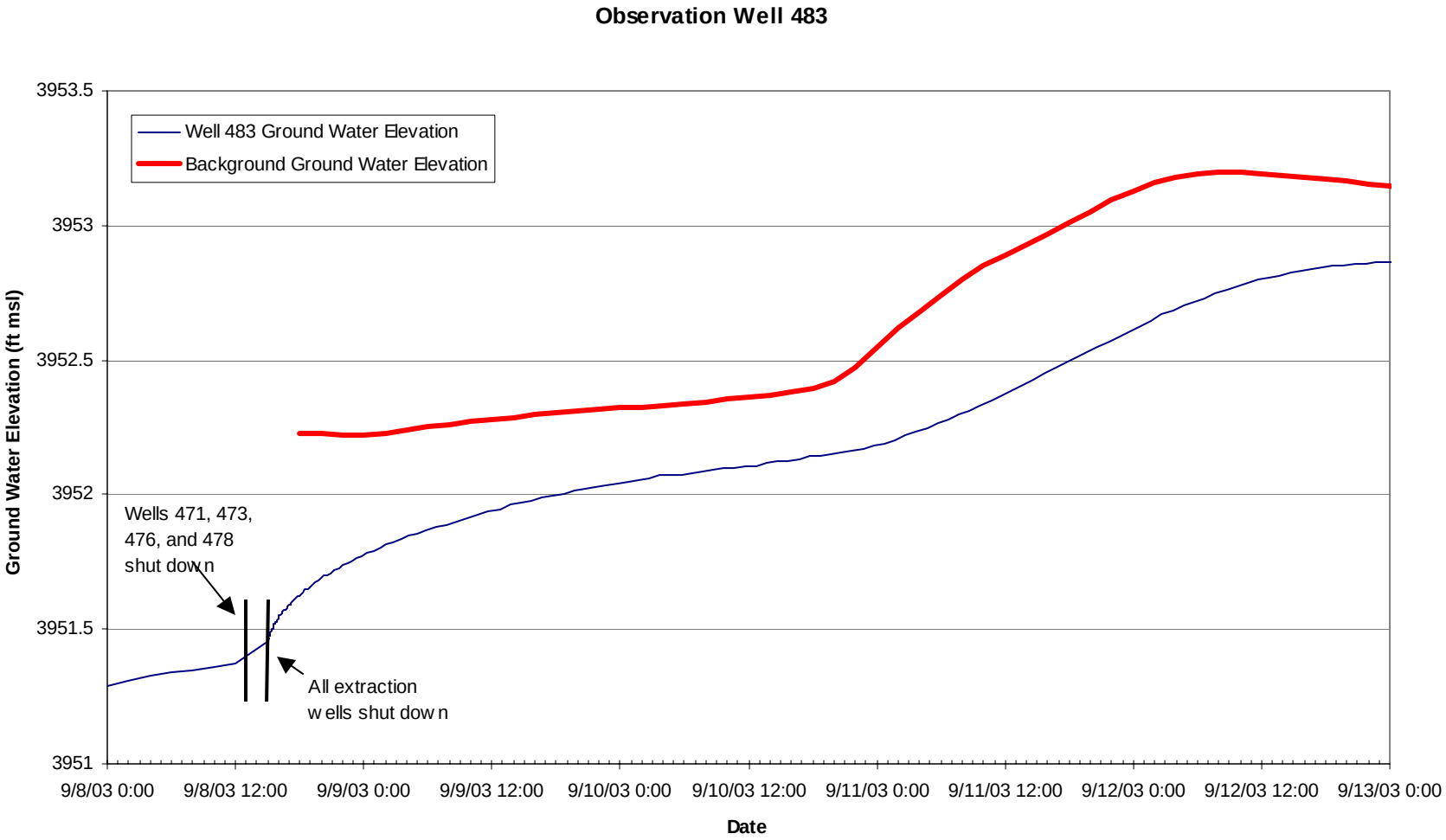
a = Data collected after 1.5 hrs of pumping from 471, 473, 476, and 478

b = Data collected after entire system shutdown for 0.5 hours

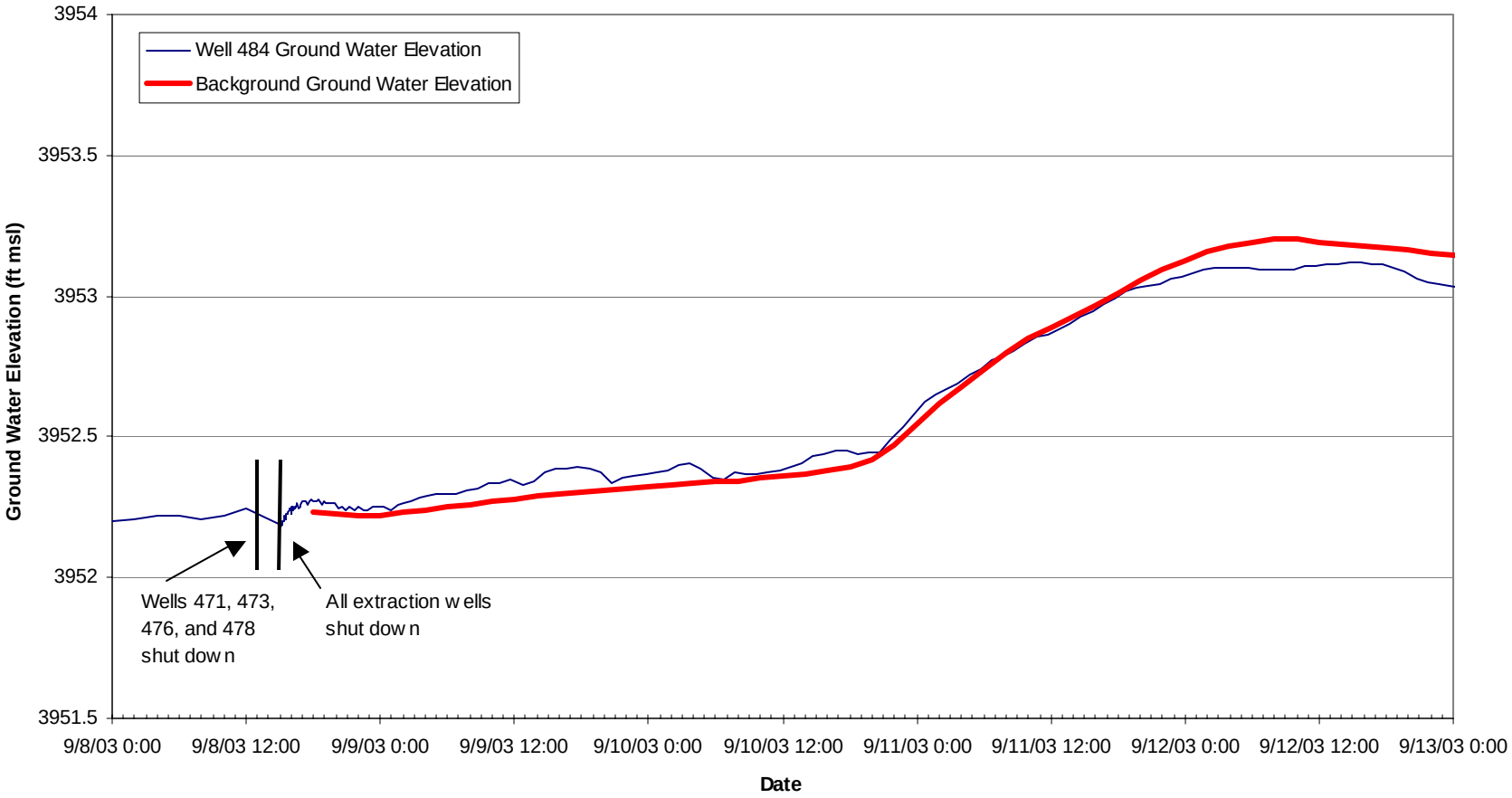

Observation Well 480
Well 480 Ground Water Elevation
Background Ground Water Elevation
Ground Water Elevation (ft msl)
3953.5
3953
3952.5
3952
3951.5
3951
Wells 471, 473, 476, and 478 shut down
All extraction wells shut down
9/8/03 0:00
9/8/03 12:00
9/9/03 0:00
9/9/03 12:00
9/10/03 0:00
9/10/03 12:00
9/11/03 0:00
9/11/03 12:00
9/12/03 0:00
9/12/03 12:00
9/13/03 0:00
Date

Observation Well 481




Observation Well 483
Well 483 Ground Water Elevation
Background Ground Water Elevation
Ground Water Elevation (ft msl)
3953.5
3953
3952.5
3952
3951.5
3951
Wells 471, 473, 476, and 478 shut down
All extraction wells shut down
9/8/03 0:00
9/8/03 12:00
9/9/03 0:00
9/9/03 12:00
9/10/03 0:00
9/10/03 12:00
9/11/03 0:00
9/11/03 12:00
9/12/03 0:00
9/12/03 12:00
9/13/03 0:00
Date

Observation Well 484



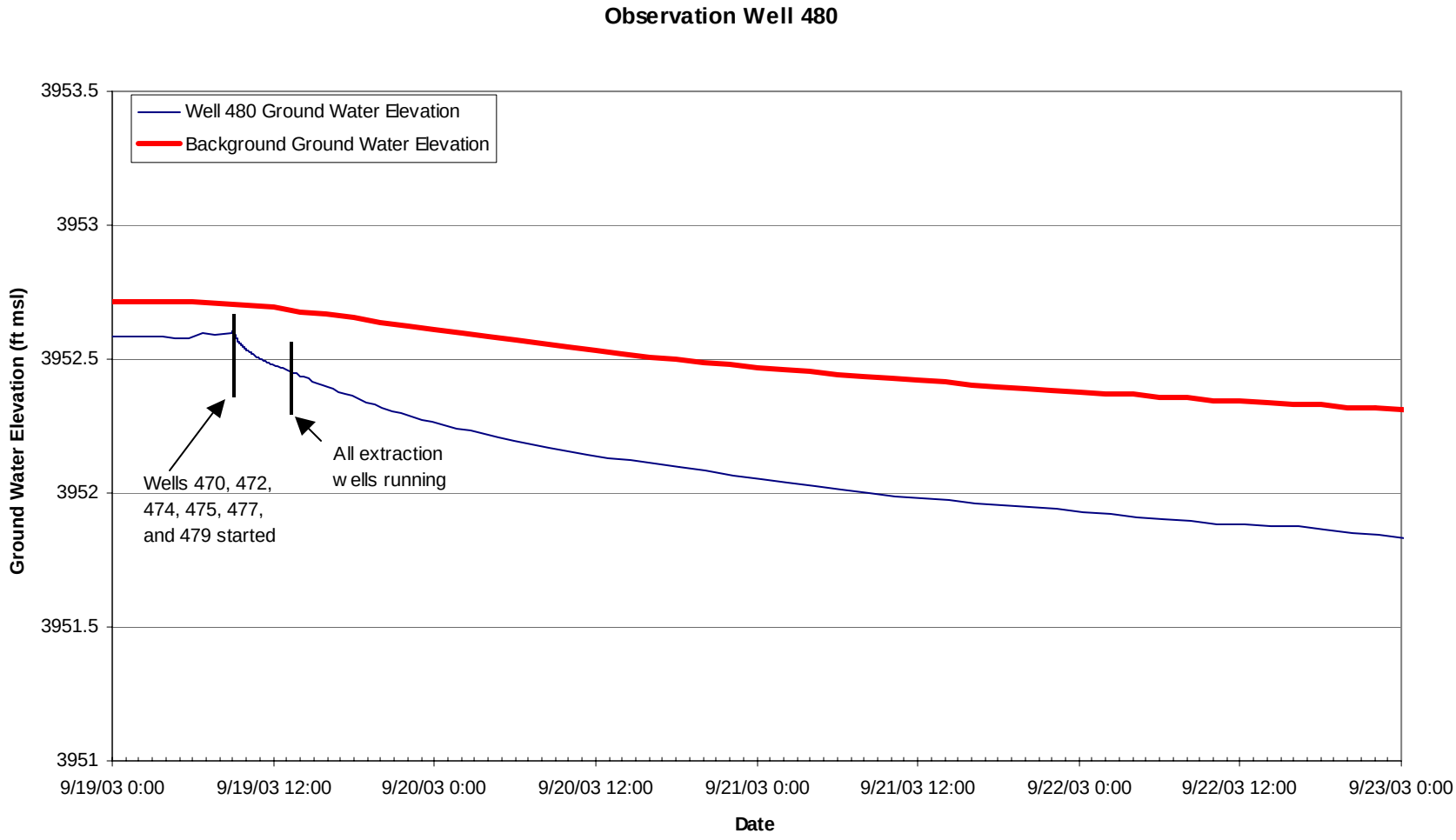
A2.0

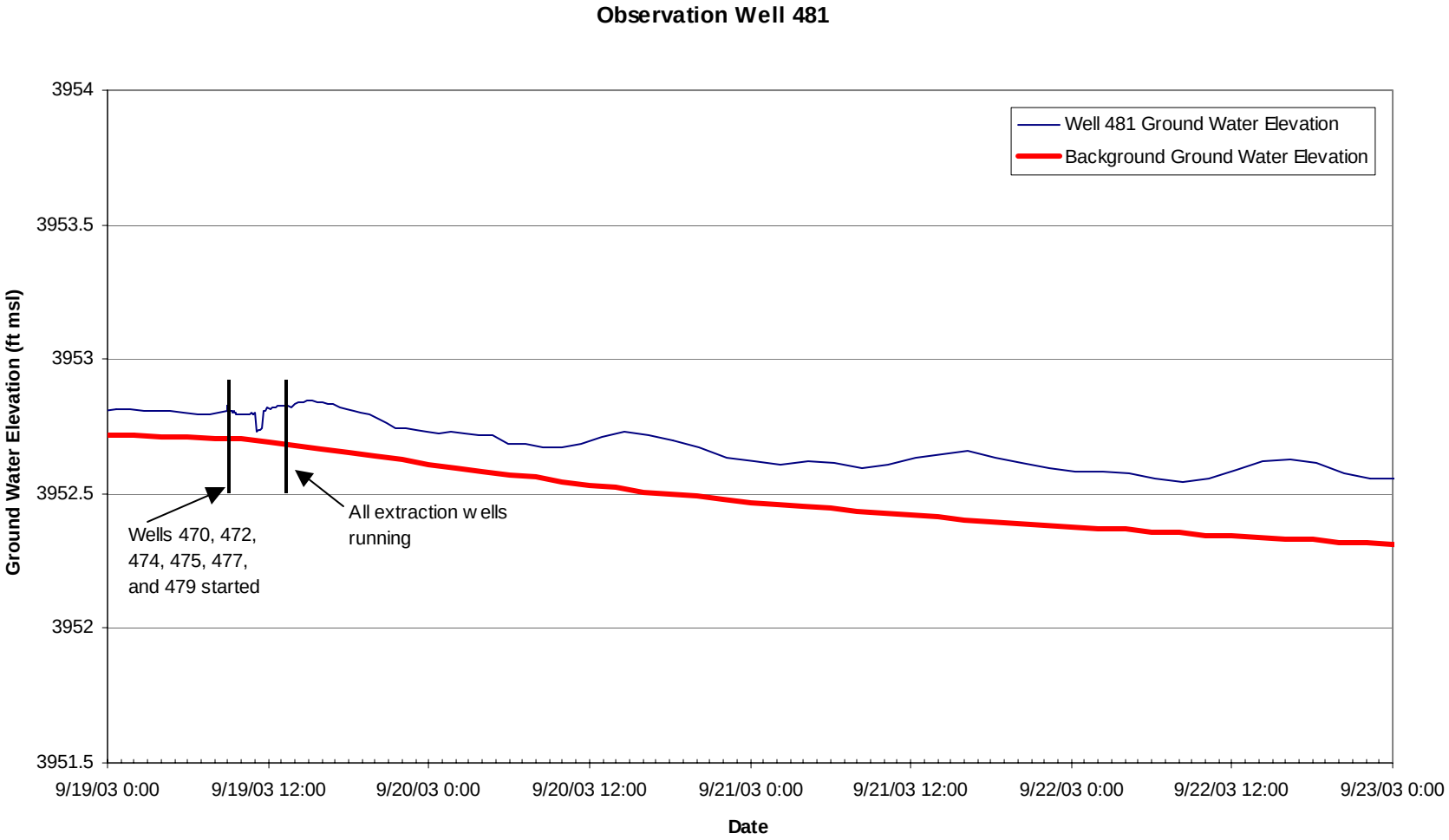
Data Collected During the September 19, 2003, System Restart

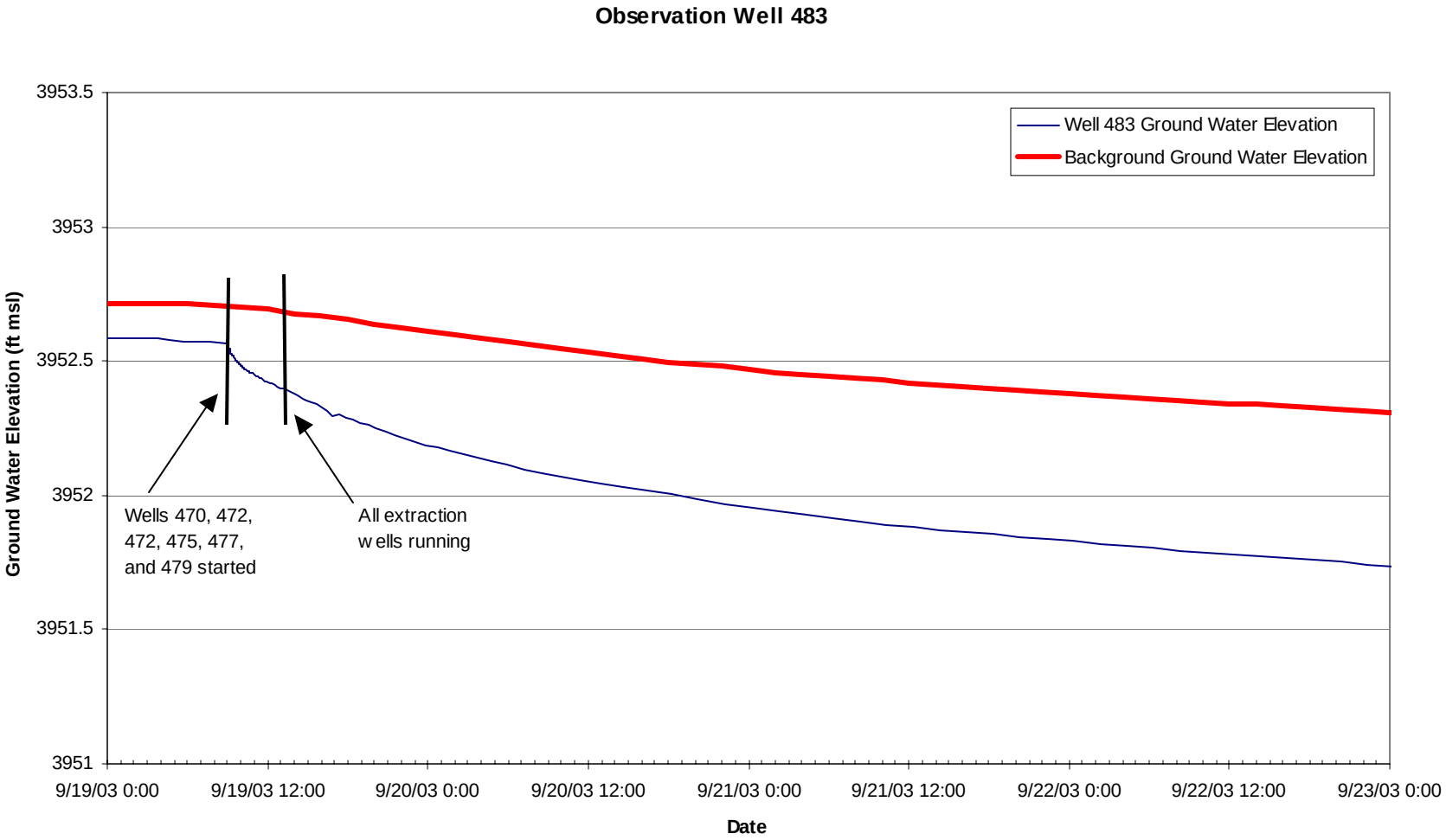
Extraction Well Field Discharge Water Field Parameter and Water Level Data Collected During the September 19, 2003 Sytem Restart

	Prior to System Restart				Wells 470, 472, 474, 475, 477, and 479 Online		Complete System Online				
Well	DTW (ft btoc)	Temp (^{o}C)	Spec Cond (uS/cm)	pH	DTW After ~1.5 hrs (ft btoc)	DTW After ~4 hrs (ft btoc)	DTW[a] (ft btoc)	DTW[b] (ft btoc)	Temp[a] (^{o}C)	Spec Cond[a] (uS/cm)	pH[a]
470	16.14	no data - well offline			19.08	19.10	19.09	19.05	16.6	32140	6.66
471	16.25	no data - well offline			16.42	16.51	16.95	17.15	19.3	33590	6.70
472	16.30	no data - well offline			17.23	17.35	17.37	17.54	17.1	28110	6.68
473	16.31	no data - well offline			16.40	16.45	17.13	17.28	18.6	24900	6.68
474	16.64	no data - well offline			17.13	17.17	17.17	17.35	19.0	25600	6.70
475	16.71	no data - well offline			17.41	17.48	17.50	17.65	19.0	25480	6.67
476	16.81	no data - well offline			16.91	16.97	17.57	17.73	18.0	24440	6.68
477	16.62	no data - well offline			17.36	17.43	17.45	17.59	17.8	23020	6.64
478	16.71	no data - well offline			16.81	16.85	17.84	17.90	18.5	23620	6.70
479	16.37	no data - well offline			16.94	16.96	17.10	17.08	18.7	22100	6.70
480	16.05	nd	nd	nd	16.15	nd	16.27	nd	17.2	33930	6.90
481	16.02	nd	nd	nd	16.09	nd	16.02	nd	16.8	33170	6.90
482	16.96	nd	nd	nd	16.96	nd	16.90	nd	16.6	109400	6.70
483	16.33	nd	nd	nd	16.46	nd	16.58	nd	17.3	27000	6.86
484	16.51	nd	nd	nd	16.52	nd	16.55	nd	16.5	36120	6.93
485	16.58	nd	nd	nd	16.55	nd	16.50	nd	16.3	109600	6.85

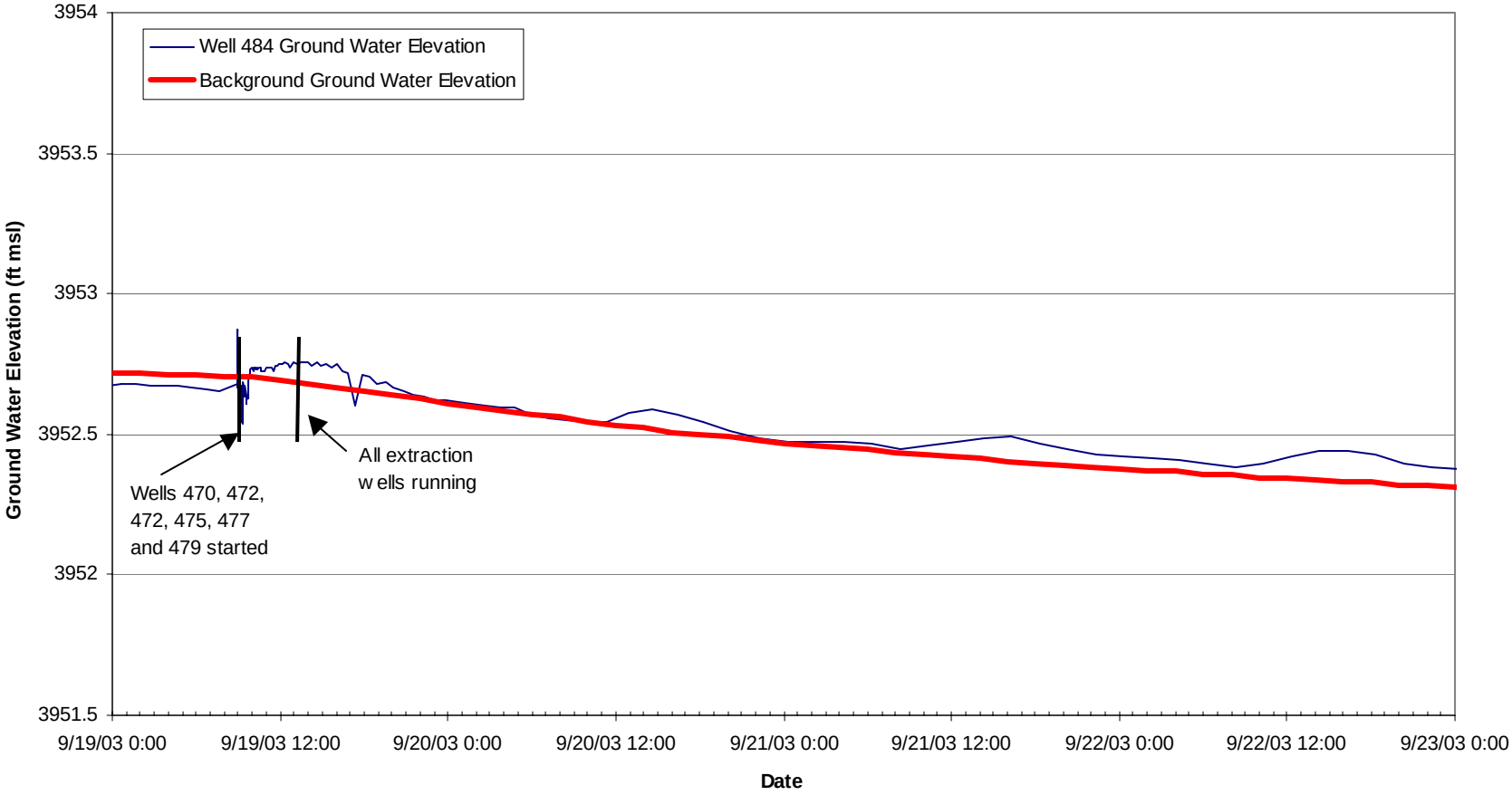
Notes: DTW = Depth to Water (ft below top of casing)
Spec Cond = Specific Conductivity
nd = no data collected
a = Data collected after ~1 hr of pumping
b = Data collected after ~5 hrs of pumping


Observation Well 480
Well 480 Ground Water Elevation
Background Ground Water Elevation
Ground Water Elevation (ft msl)
3953.5
3953
3952.5
3952
3951.5
3951
Wells 470, 472, 474, 475, 477, and 479 started
All extraction w ells running
9/19/03 0:00
9/19/03 12:00
9/20/03 0:00
9/20/03 12:00
9/21/03 0:00
9/21/03 12:00
9/22/03 0:00
9/22/03 12:00
9/23/03 0:00
Date

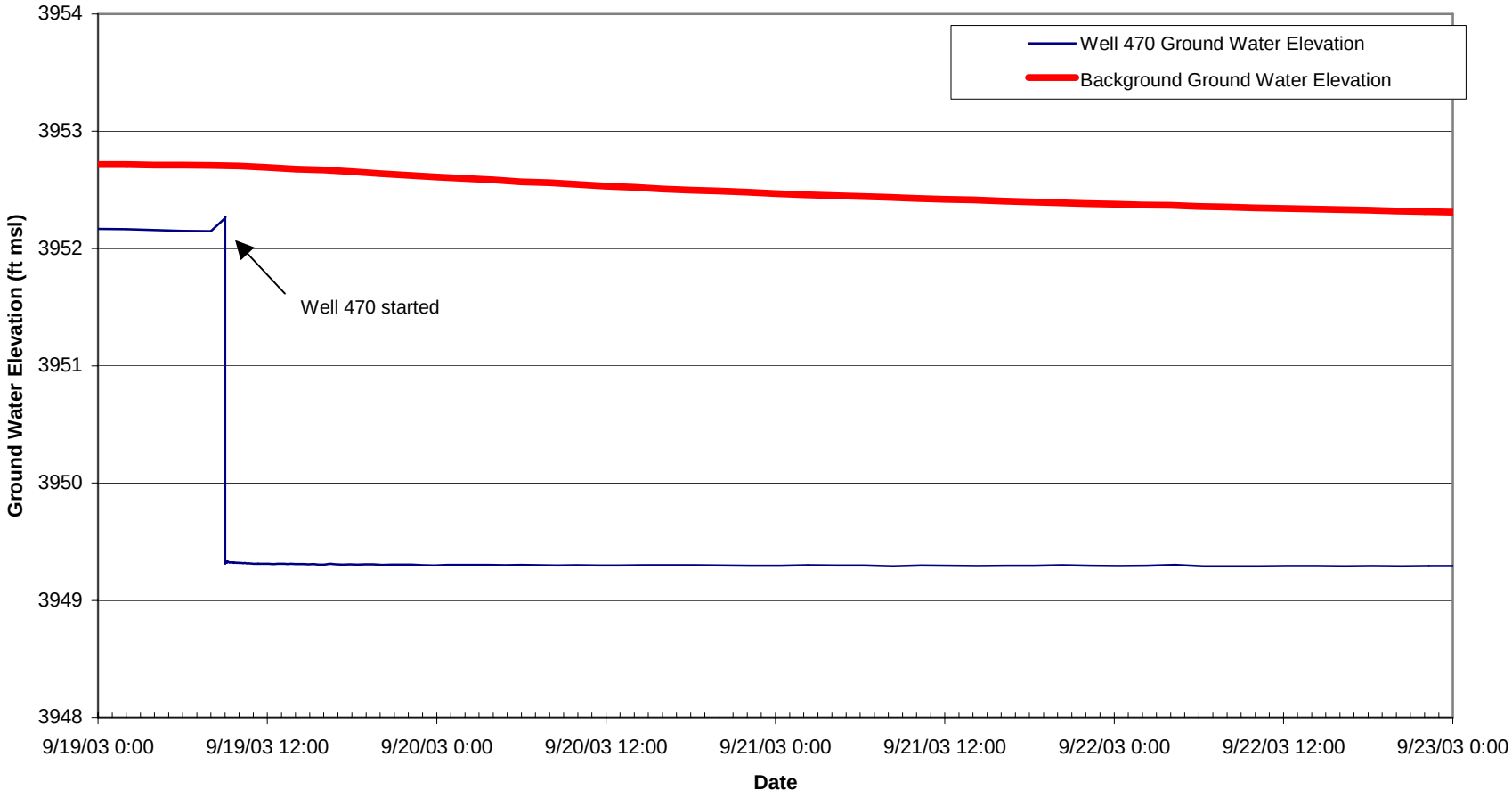

Observation Well 481
Well 481 Ground Water Elevation
Background Ground Water Elevation
Ground Water Elevation (ft msl)
3954
3953.5
3953
3952.5
3952
3951.5
Wells 470, 472, 474, 475, 477, and 479 started
All extraction wells running
9/19/03 0:00
9/19/03 12:00
9/20/03 0:00
9/20/03 12:00
9/21/03 0:00
9/21/03 12:00
9/22/03 0:00
9/22/03 12:00
9/23/03 0:00
Date


Observation Well 483
Well 483 Ground Water Elevation
Background Ground Water Elevation
Ground Water Elevation (ft msl)
3953.5
3953
3952.5
3952
3951.5
3951
Wells 470, 472, 472, 475, 477, and 479 started
All extraction w ells running
9/19/03 0:00
9/19/03 12:00
9/20/03 0:00
9/20/03 12:00
9/21/03 0:00
9/21/03 12:00
9/22/03 0:00
9/22/03 12:00
9/23/03 0:00
Date

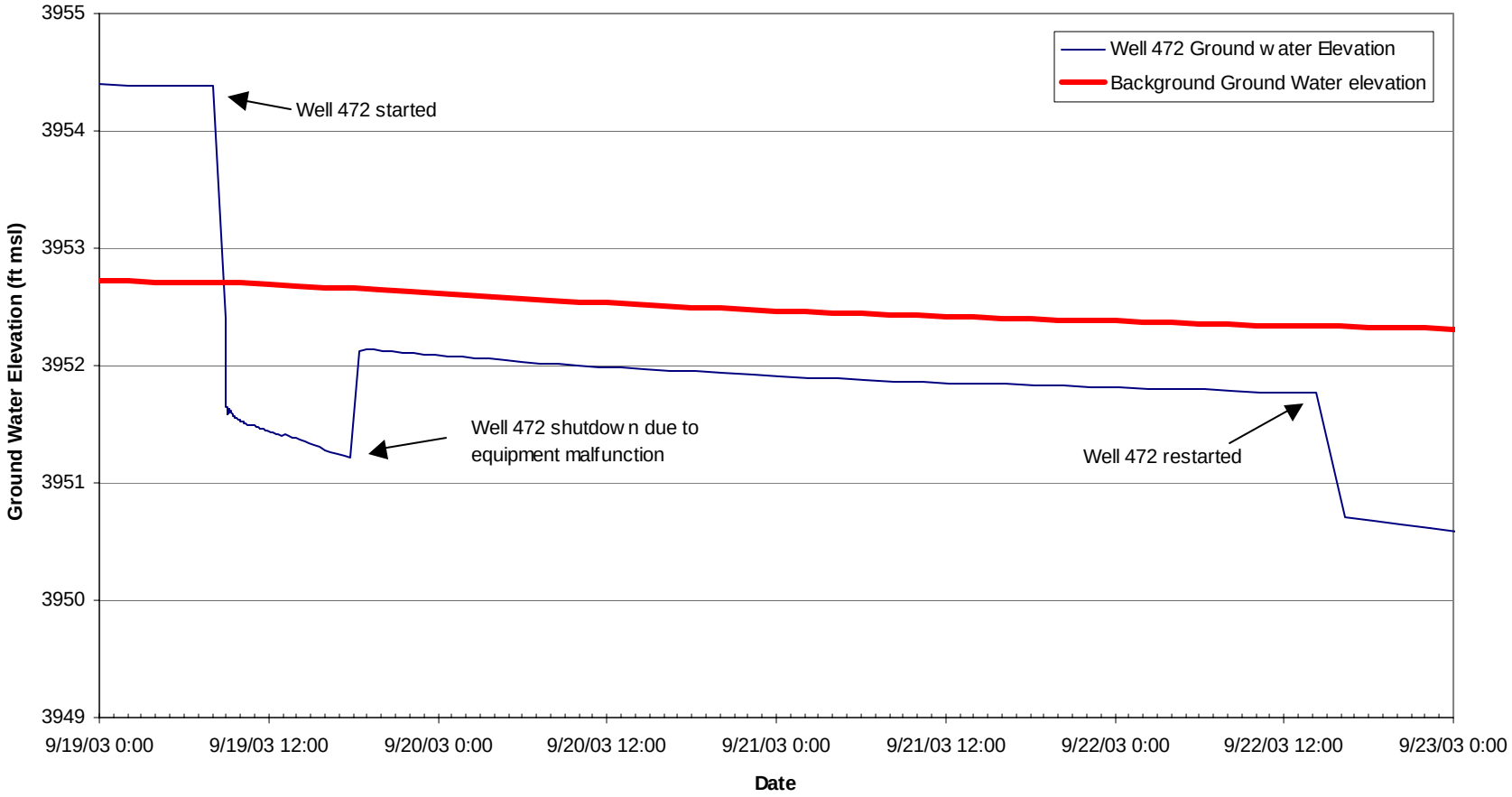
Observation Well 484



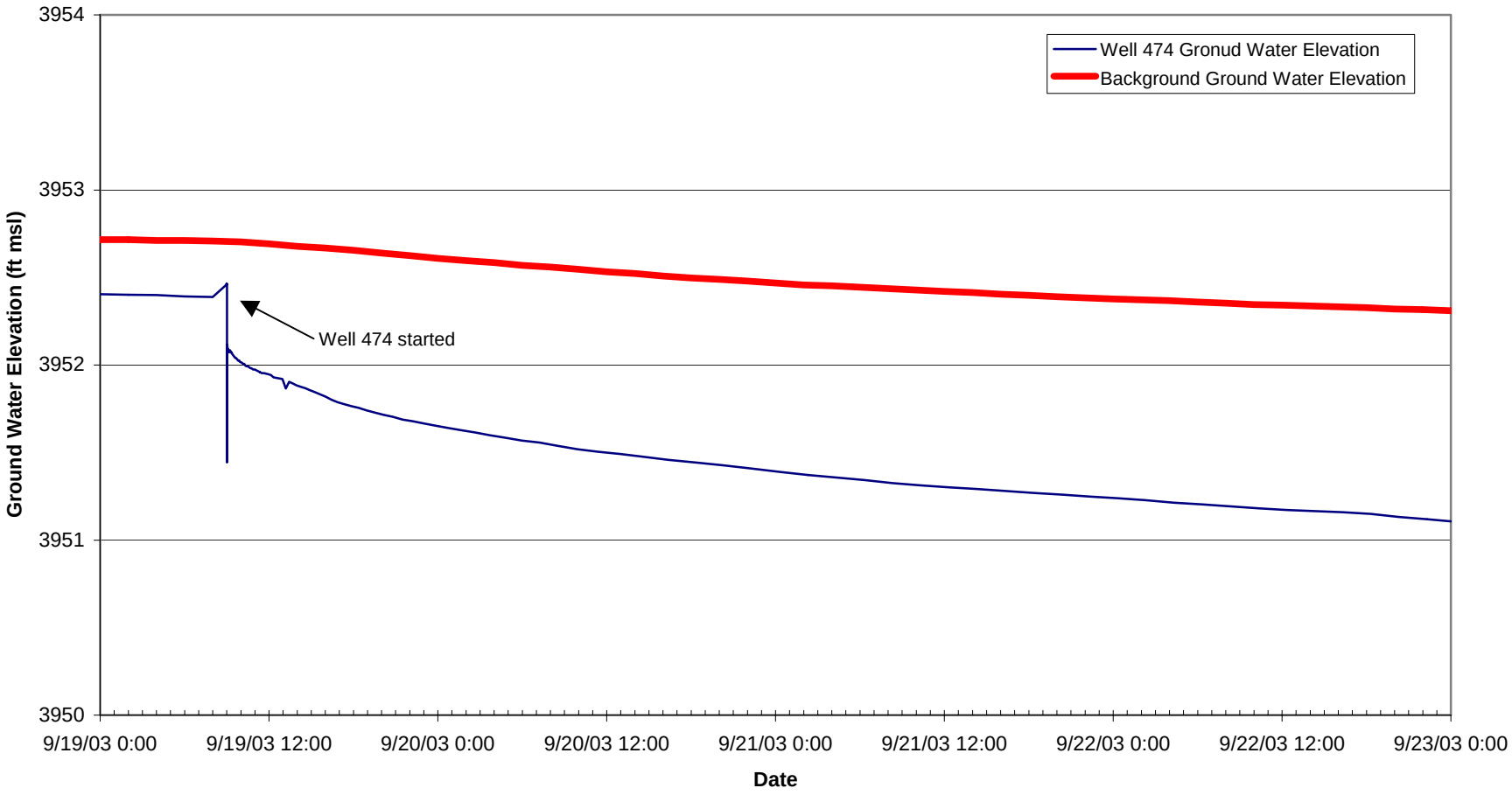
Extraction Well 470

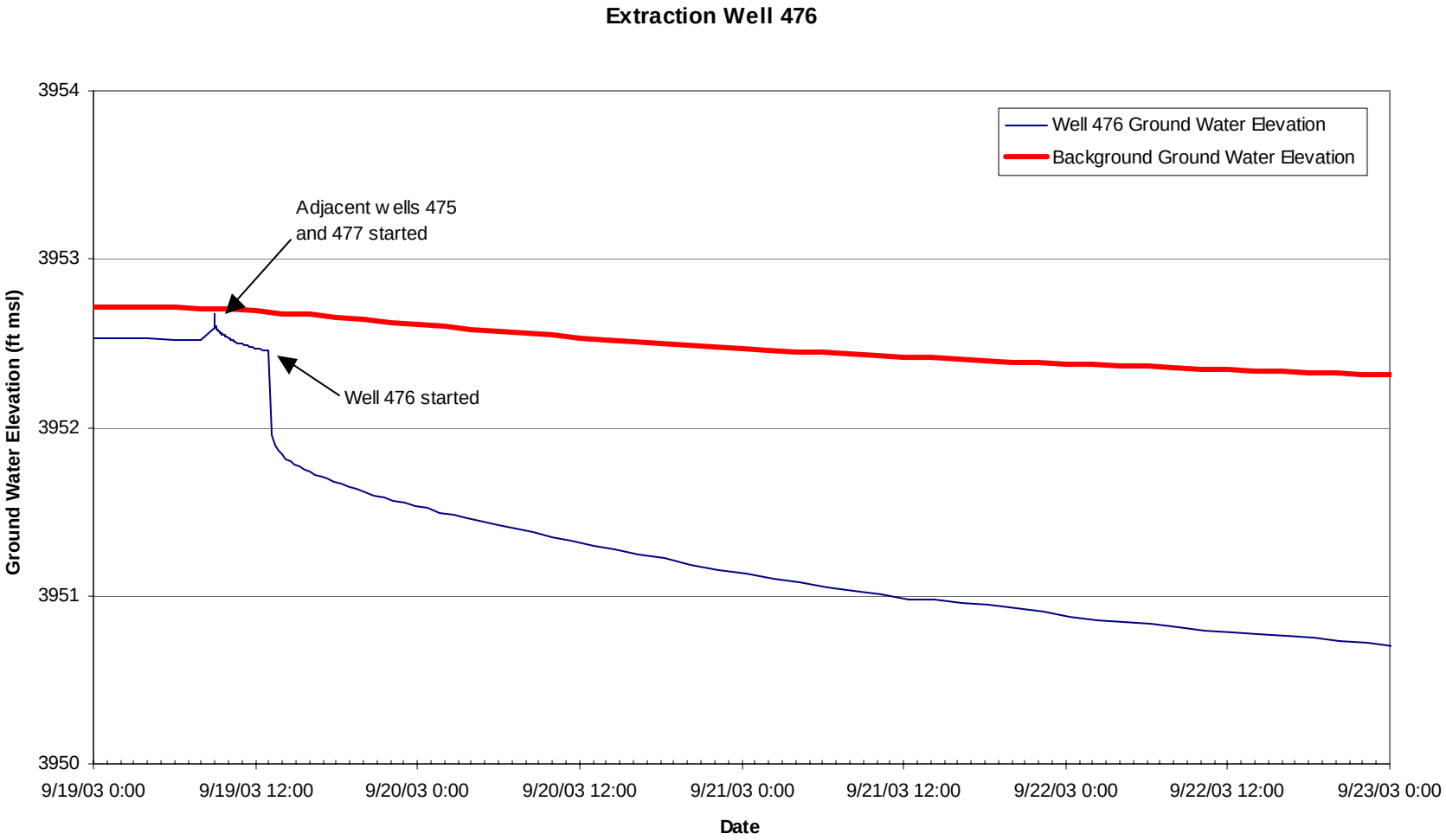


Extraction Well 472

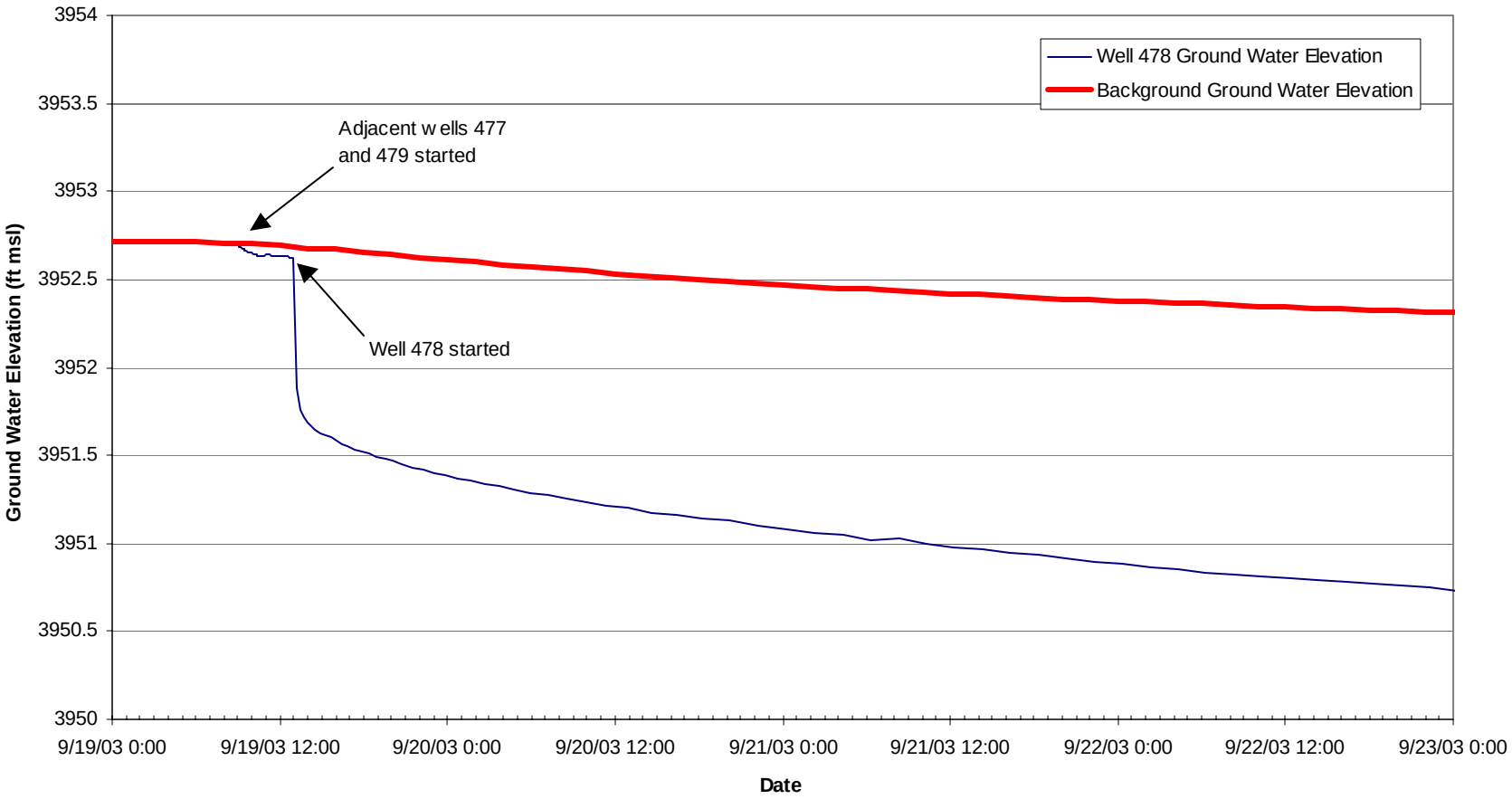


Extraction Well 474




Extraction Well 476
Well 476 Ground Water Elevation
Background Ground Water Elevation
Adjacent w ells 475
and 477 started
Well 476 started
Ground Water Elevation (ft msl)
3954
3953
3952
3951
3950
9/19/03 0:00
9/19/03 12:00
9/20/03 0:00
9/20/03 12:00
9/21/03 0:00
9/21/03 12:00
9/22/03 0:00
9/22/03 12:00
9/23/03 0:00
Date

Extraction Well 478



Appendix B

Extraction and Observation Well Data

Date	Time	Well 470							comments
		Depth to water (ft)	flow rate gpm	total vol (l) gls	pressure psi	temp °C	spec cond µS/cm x1K	pH	
9/8/2003	11:09	19.05	5.50	81,814	50	16.40	31.20	6.91	
9/17/2003	18:45	16.07							Pump off
9/19/2003	8:00	16.14	0.00						system off since 9/8/03
10/8/2003	10:09	19.13	4.70	217,500	55	17.10	30.99	7.08	
10/14/2003	11:05	19.10	4.78	253,214	52	16.28	28.06	7.11	
10/16/2003	11:25	19.11	4.65	265,531	52	16.69	27.84	7.12	
10/20/2003	11:37	19.12	5.41	289,573	48	16.26	27.31	7.07	
10/21/2003	12:50		5.22	295,598					
10/23/2003	11:05	18.70	3.94	306,543	126	16.34	27.20	7.04	
10/27/2003	10:59	18.78	3.94	329,338	136	16.18	27.61	7.04	Probe stuck
10/30/2003	9:36	18.60	3.94	345,979	138	16.18	26.89	7.04	
11/3/2003	10:30	18.68	3.88	368,752	138	16.14	27.26	7.04	
11/6/2003	12:22	18.82	3.94	386,061	138	15.78	28.72	6.93	
11/10/2003	11:32	18.88	3.88	408,127	138	15.16	28.62	7.02	
11/13/2003	10:45	18.53	3.88	424,638	138	14.61	27.91	7.03	
11/17/2003	10:23	18.60	3.88	446,750	136	14.57	23.73	7.05	
11/20/2003	10:32	18.65	3.88	436,491	136	13.15	28.23	7.02	
11/24/2003	11:23	18.78	3.88	486,187	137	11.18	28.45	7.06	
12/1/2003	10:52	18.50	3.75	524,733	116	10.74	28.50	7.09	
12/4/2003	10:03	19.02	3.88	541,033	112	12.70	28.18	7.05	
12/8/2003	10:52	19.10	4.01	563,767	112	12.84	27.95	7.09	Pump lowered 2 ft on 12/9/03
12/11/2003	10:29	19.70	4.39	581,461	135	10.10	28.13	7.14	
12/15/2003	10:55	19.80	4.33	606,119	136	10.61	27.98	7.09	
12/18/2003	10:06	18.26	1.4	619,456	142	11.37	27.09	7.07	Change GPM to 2.10
12/22/2003	10:22	18.25	2.86	636,336	143	10.66	27.02	7.09	
12/27/2003	13:00								Power failure - shut system down for winter

Date	Time	Well 471							comments
		Depth to water (ft)	flow rate gpm	total vol (l) gls	pressure psi	temp °C	spec cond µS/cm x1K	pH	
9/8/2003	11:35	18.00	2.11	44,850	140	16.80	33.48	6.82	
9/17/2003	18:40	16.25							Pump off
9/19/2003	8:00	16.25	0.00						system off since 9/8/03
10/8/2003	10:11	18.49	2.60	116,913	132	17.80	33.97	7.02	
10/14/2003	11:25	18.55	2.62	139,938	126	16.67	31.32	7.63	
10/16/2003	11:15	18.51	2.62	147,468	132	17.12	31.26	7.01	
10/20/2003	11:28	18.53	2.62	162,486	130	16.99	30.53	7.00	
10/21/2003	12:52		2.62	166,519					
10/23/2003	10:55	18.58	2.62	173,749	132	16.73	29.27	7.00	
10/27/2003	10:45	18.62	2.62	188,904	130	16.43	29.22	7.00	
10/30/2003	9:34	18.60	2.62	200,040	135	16.53	28.98	7.01	
11/3/2003	10:24	18.53	2.56	215,105	132	15.91	28.38	7.05	
11/6/2003	12:16	18.63	3.07	226,351	128	14.70	31.50	6.97	
11/10/2003	11:25	19.03	3.13	243,789	128	15.15	31.56	6.92	
11/13/2003									Pump off, may be bad, 243876 total
11/17/2003									Bad Pump
11/20/2003									Pump is down
11/24/2003	3:15	18.80	3.52	243,930	117	12.24	31.04	7.02	Start pump at 243876 total
12/1/2003	10:44	19.72	3.58	278,887	120	13.03	32.12	7.00	Pump lowered 2.5 ft on 11/24/03
12/4/2003	9:58	20.99	3.58	294,160	120	13.74	32.18	6.98	
12/8/2003	10:46	19.73	3.58	314,995	120	14.62	31.89	6.98	
12/11/2003	10:18	21.30	4.22	332,173	116	11.88	31.48	7.03	Probe stuck
12/15/2003	10:46	21.60	4.03	356,222	106	11.25	32.90	7.04	
12/18/2003	9:53	18.55	2.04	370,400	124	12.5	29.63	7.03	
12/22/2003	10:16	18.53	1.98	382,095	124	13.30	30.24	7.01	
12/27/2003	13:00								Power failure - shut system down for winter

Date	Time	Well 472							comments
		Depth to water (ft)	flow rate gpm	total vol (l) gls	pressure psi	temp °C	spec cond µS/cm x1K	pH	
9/8/2003	11:44	19.00	5.15		140	16.50	31.64	6.82	
9/17/2003	18:05	16.21							Pump off
9/19/2003	8:00	16.30	0.00						system off since 9/8/03
10/8/2003	10:12	18.83	3.00	60,334	138	17.40	30.71	6.99	Milky
10/14/2003	11:45	18.95	3.03			16.59	28.02	7.00	Probe stuck, take top off
10/16/2003	11:07	18.95	3.03	83,759	138	17.11	27.70	7.01	
10/20/2003	11:19	18.93	3.01	94,460	138	16.76	27.80	7.03	
10/21/2003	12:52		3.01	97,359					
10/23/2003	10:48	18.98	3.01	102,518	139	16.57	27.40	7.02	
10/27/2003	10:37	19.03	2.99	113,407	139	16.15	27.20	7.03	
10/30/2003	9:30	19.00	2.99	121,381	140	16.34	27.17	7.04	
11/3/2003	10:18	19.02	3.01	132,941	138	16.18	24.93	7.05	
11/6/2003	12:10	19.10	2.99	145,919	138	15.16	28.32	6.98	
11/10/2003	11:18	19.10	2.99	163,649	120	14.89	28.50	7.03	
11/13/2003	10:37	19.10	3.30	176,253	137	14.99	28.78	7.00	
11/17/2003	10:16	19.10	3.29	194,680	136	14.46	29.29	7.04	
11/20/2003	10:24	19.10	3.23	208,316	120	13.57	29.69	7.00	
11/24/2003	11:15	19.10	3.16	226,429	110	11.85	29.37	7.04	
12/1/2003	10:37	19.10	2.67	253,336	80	12.14	28.29	7.04	
12/4/2003	9:54	19.10	2.61	264,371	82	11.74	28.55	7.05	
12/8/2003	10:39	19.10	2.85	279,257	80	12.94	28.75	7.03	Pump lowered 2 ft on 12/8/03
12/11/2003	10:12	21.10	4.05	296,503	118	10.50	27.98	7.08	
12/15/2003	10:40	21.10	3.76	318,428	114	11.21	29.06	7.11	
12/18/2003	9:47	18.8	2.02	331,199	136	12.88	29.06	7.04	
12/22/2003	10:08	18.75	2.02	392,043	137	13.42	29.69	7.01	
12/27/2003	13:00								Power failure - shut system down for winter

Date	Time	Well 473							comments
		Depth to water (ft)	flow rate gpm	total vol (l) gls	pressure psi	temp °C	spec cond µS/cm x1K	pH	
9/8/2003	11:51	19.00	1.85	40,513	120	17.30	26.01	6.82	
9/17/2003	18:05	16.23							Pump off
9/19/2003	8:00	16.31	0.00						system off since 9/8/03
10/8/2003	10:14	19.06	2.30	98,009	125	18.10	26.50	6.96	
10/14/2003	1:00	19.06	2.17	115,805	100	17.92	24.08	7.00	
10/16/2003	10:58	19.08	2.17	121,682	100	17.52	23.77	6.99	
10/20/2003	11:10	19.03	2.11	133,597	100	17.38	23.55	7.01	
10/21/2003	12:53		2.11	136,811					
10/23/2003	10:40	19.06	1.98	142,332	92	16.76	20.27	7.03	
10/27/2003	10:30	19.10	1.85	153,368	100	16.56	22.66	7.00	
10/30/2003	9:27	19.02	1.92	161,475	90	16.60	22.60	7.07	
11/3/2003	10:11	19.10	1.92	172,832	92	16.55	23.38	6.99	
11/6/2003	12:04	19.18	1.79	181,193	82	15.42	24.59	6.94	
11/10/2003	12:01	19.00	1.72	191,216	130	15.74	24.35	6.99	Pump kicked out while sampling
11/13/2003	10:52	19.03	2.04	198,594	100	14.50	25.32	6.96	Pump kicked out while sampling
11/17/2003	10:08	19.10	1.79	208,807	84	15.95	25.22	6.94	
11/20/2003	10:19	19.10	1.85	216,390	80	14.62	25.43	6.97	
11/24/2003	11:07	19.10	1.98	226,199	80	14.45	25.35	6.96	
12/1/2003	10:28	19.10	1.53	241,030	70	15.09	25.26	6.98	
12/4/2003	9:47	19.08	1.53	247,177	70	14.59	25.59	7.03	
12/8/2003	10:32	19.10	1.85	255,702	65	15.28	25.20	6.99	Pump lowered 2 ft on 12/8/03
12/11/2003	10:06	20.68	1.98	264,708	126	15.54	26.17	7.00	
12/15/2003	10:32	20.60	1.92	276,081	126	15.45	26.04	6.99	
12/18/2003	9:41	20.6	1.98	284,525	126	15.1	25.76	6.98	
12/22/2003	10:02	20.62	1.98	296,052	126	14.71	25.96	6.98	Probe stuck
12/27/2003	13:00								Power failure - shut system down for winter

Date	Time	Well 474							comments
		Depth to water (ft)	flow rate gpm	total vol (l) gls	pressure psi	temp °C	spec cond µS/cm x1K	pH	
9/8/2003	11:57	18.40	2.04	39,784	145	17.50	26.16	6.83	
9/17/2003	17:55	16.58							Pump off
9/19/2003	8:00	16.64	0.00						system off since 9/8/03
10/8/2003	10:19	19.10	3.00	103,837	143	18.10	26.70	6.98	
10/14/2003	1:15	19.10	2.74	129,163	130	17.99	24.40	6.99	
10/16/2003	10:48	19.11	2.68	136,707	124	17.14	24.38	7.00	
10/20/2003	11:00	19.10	2.81	152,387	120	17.03	24.30	7.05	
10/21/2003	12:54		2.74	156,746					
10/23/2003	10:30	19.12	2.81	162,691	108	16.39	23.41	7.04	
10/27/2003	10:23	19.10	2.49	176,162	85	15.91	23.64	7.02	Milky
10/30/2003	9:23	19.10	2.42	186,763	90	16.46	22.33	7.03	
11/3/2003	10:05	19.10	2.68	200,908	90	15.98	24.13	7.02	
11/6/2003	11:57	19.10	2.23	211,328	80	15.19	25.34	6.93	
11/10/2003	11:05	19.10	2.17	224,115	80	15.50	25.55	6.90	
11/13/2003	10:16	19.10	2.55	233,968	100	14.84	25.66	6.95	
11/17/2003	10:00	19.10	2.87	247,235	82	14.85	25.82	6.95	
11/20/2003	10:10	19.05	2.81	256,432	80	14.03	25.94	6.97	Filter leaking (tightened)
11/24/2003	10:59	19.10	2.17	269,658	80	13.34	25.96	6.99	Leak by sample valve
12/1/2003	10:20	19.10	1.91	290,953	70	19.39	25.80	7.05	Had trouble with probe
12/4/2003	9:39	19.13	1.98	299,244	70	9.39	26.60	7.17	
12/8/2003	11:20	18.80	2.17	308,410	70	11.06	27.03	7.04	Well was not pumping when first checked
12/11/2003	10:00	19.30	2.42	314,807	122	10.66	27.64	7.03	Pump lowered 2 ft on 12/8/03
12/15/2003	10:26	19.42	2.42	328,614	120	10.26	25.50	7.01	
12/18/2003	9:35	19.33	2.36	338,769	120	11.33	27.45	6.97	
12/22/2003	9:52	19.30	2.36	352,622	120	10.34	27.37	7.00	
12/27/2003	13:00								Power failure - shut system down for winter

Date	Time	Well 475							comments
		Depth to water (ft)	flow rate gpm	total vol (l) gls	pressure psi	temp °C	spec cond µS/cm x1K	pH	
9/8/2003	12:02	18.95	1.96	37,266	145	17.90	23.18	6.83	
9/17/2003	17:45	16.65							Pump off
9/19/2003	8:00	16.71	0.00						system off since 9/8/03
10/8/2003	10:19	19.00	2.00	86,549	138	19.50	22.39	7.34	
10/14/2003	1:35	19.10	1.83	99,637	120	18.90	22.12	7.01	Kicked out
10/16/2003	10:24	19.07	1.83	103,797	120	17.39	22.00	7.06	
10/20/2003	10:50	19.10	1.90	111,977	132	17.09	21.55	7.10	
10/21/2003	15:05	20.10	2.72	114,188			22.72	6.98	Pump intake lowered
10/23/2003	10:20	20.45	2.53	121,226	130	16.82	22.02	6.99	Milky
10/27/2003	10:13	20.43	2.47	135,380	128	16.07	21.62	7.00	Milky
10/30/2003	9:19	20.48	2.47	145,996	122	16.45	21.59	7.00	
11/3/2003	9:59	20.43	2.53	160,319	130	16.42	21.86	7.03	
11/6/2003	11:51	20.43	2.53	170,983	106	15.37	22.91	6.94	
11/10/2003	10:58	20.45	2.53	184,005	134	15.38	22.99	6.95	
11/13/2003	10:08	20.43	2.85	184,384	110	14.52	23.45	6.93	
11/17/2003	9:52	19.63	2.60	209,039	108	13.40	23.60	7.02	
11/20/2003	10:00	20.43	2.47	219,787	108	13.03	23.87	6.98	
11/24/2003	10:51	20.42	2.47	234,105	100	10.96	23.93	7.01	
12/1/2003	10:08	20.42	2.22	257,816	110	9.62	24.16	7.08	
12/4/2003	9:34	20.40	2.34	267,752	106	10.57	25.19	7.03	Pump lowered 2 ft on 12/4/03
12/8/2003	10:22	20.03	2.34	280,955	136	13.40	24.41	6.97	
12/11/2003	9:53	20.45	2.34	290,840	136	11.38	25.41	6.99	
12/15/2003	10:06	20.65	2.34	304,252	136	10.40	24.78	7.05	
12/18/2003	9:29	20.6	2.34	314,163	136	10	25.55	7.03	
12/22/2003	9:46	20.48	2.28	327,621	136	12.46	24.99	6.95	
12/27/2003	13:00								Power failure - shut system down for winter

Date	Time	Well 476							comments
		Depth to water (ft)	flow rate gpm	total vol (l) gls	pressure psi	temp °C	spec cond µS/cm x1K	pH	
9/8/2003	12:13	19.00	1.62	32,377	135	19.70	23.30	6.91	
9/17/2003	17:00	16.68							Pump off
9/19/2003	8:00	16.81	0.00						system off since 9/8/03
10/8/2003	10:20	19.10	1.20	46,316	80-100	18.70	22.93	7.07	
10/14/2003	1:50	19.09	0.77	53,299	90	18.34	21.30	7.03	
10/16/2003	10:35	19.05	0.90	55,423	70	17.13	21.41	7.35	Pump was kicked out before sample
10/20/2003	10:39	19.10	1.10	60,191	53	16.73	21.53	7.21	Pump kick out while testing
10/21/2003	15:10	20.10	1.90	61,406	135	18.27	22.31	6.98	Pump intake was lowered
10/23/2003	10:14	20.36	1.68	66,179	118	16.50	21.77	7.06	
10/27/2003	10:01	20.35	1.62	75,416	110	16.00	21.47	7.02	Milky
10/30/2003	9:14	20.37	1.74	82,668	95	16.75	21.53	6.98	Milky
11/3/2003	9:53	20.33	1.68	91,385	120	16.85	21.95	6.98	
11/6/2003	11:45	20.38	1.55	98,187	100	16.00	23.17	6.92	
11/10/2003	10:51	20.40	1.62	106,966	100	15.88	22.75	6.91	
11/13/2003	10:00	20.38	1.55	133,621	90	13.56	23.03	7.03	
11/17/2003	9:45	20.10	1.42	122,349	70	14.40	23.41	6.98	
11/20/2003	9:51	20.38	1.49	128,448	70	13.82	23.57	6.92	
11/24/2003	10:43	20.36	1.49	137,148	65	10.30	23.80	6.99	
12/1/2003	10:00	70.40	1.42	151,478	65	10.00	24.23	7.02	
12/4/2003	9:28	20.35	1.49	157,391	65	9.95	23.25	7.02	Pump lowered 2 ft on 12/4/03
12/8/2003	10:16	20.05	1.36	165,091	142	14.49	23.99	6.94	
12/11/2003	9:46	20.20	1.36	171,011	142	12.91	24.21	6.98	
12/15/2003	9:59	20.38	1.42	118,969	142	13.66	23.89	6.96	
12/18/2003	9:23	20.4	1.36	184,901	142	14.03	24.42	6.99	
12/22/2003	9:40	20.25	1.29	192,654	142	12.12	24.26	6.96	
12/27/2003	13:00								Power failure - shut system down for winter

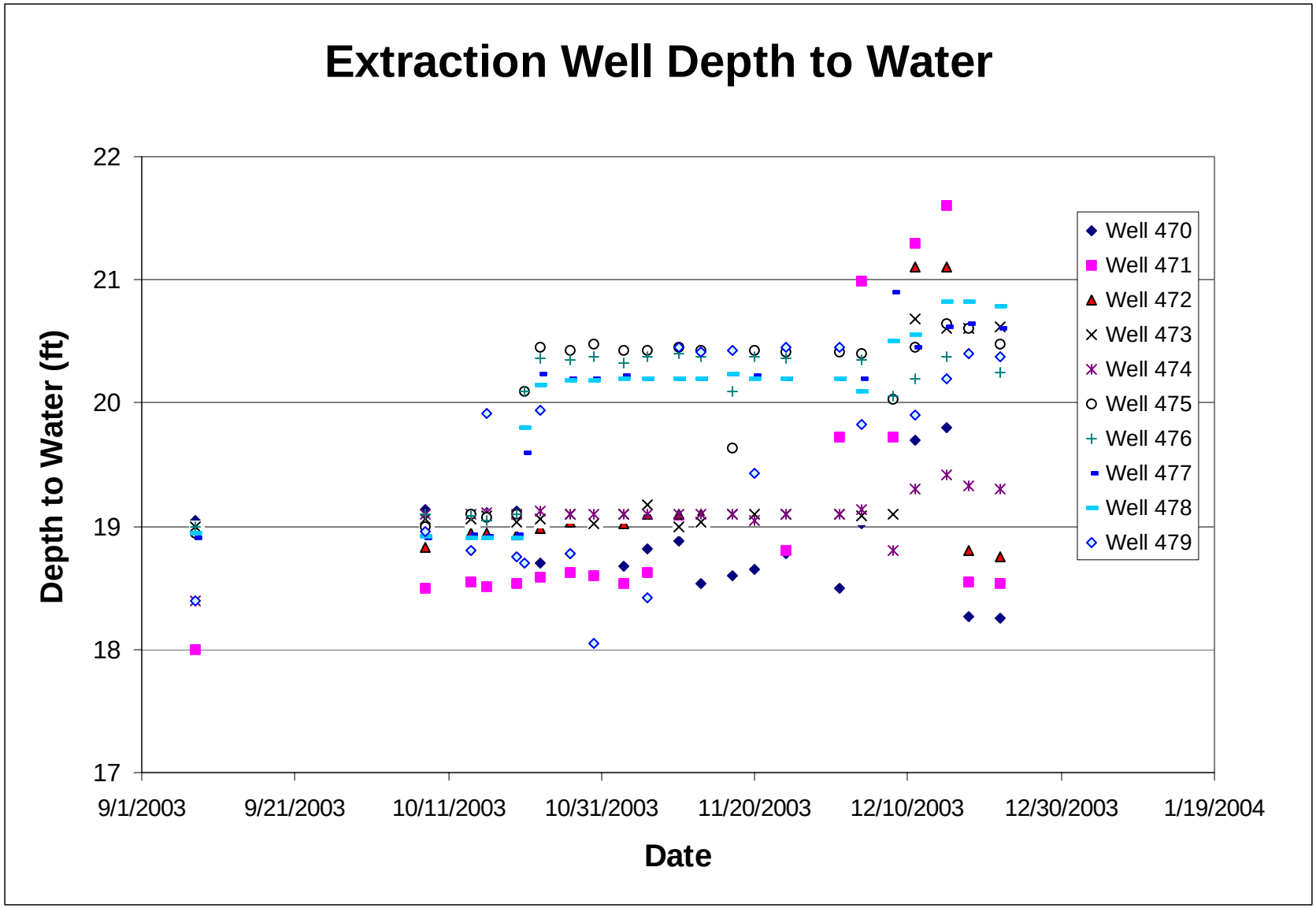
Date	Time	Well 477							comments
		Depth to water (ft)	flow rate gpm	total vol (l) gls	pressure psi	temp °C	spec cond µS/cm x1K	pH	
9/8/2003	12:18	18.90	2.04	36,933	125	17.90	23.15	6.87	
9/17/2003	15:40	16.50							Pump off
9/19/2003	8:00	16.62	0.00						system off since 9/8/03
10/8/2003	10:25	18.91	1.85	90,069	110	18.10	21.85	7.00	
10/14/2003	2:05	18.93	1.79	105,770	106	18.16	20.49	7.04	
10/16/2003	10:10	18.92	1.72	110,429	106	6.81	18.97	7.07	
10/20/2003	10:25	18.93	1.72	120,644	110	16.25	20.69	7.15	
10/21/2003	15:14	19.60	2.50	123,474	120	17.48	20.88	6.98	Pump intake lowered
10/23/2003	10:05	20.23	2.68	130,782	110	15.95	20.31	7.02	
10/27/2003	9:50	20.20	2.62	145,946	110	15.79	20.94	6.97	Milky
10/30/2003	9:10	20.20	2.62	157,236	110	16.02	20.82	6.97	Milky
11/3/2003	9:46	20.22	2.62	172,441	110	15.92	20.30	7.00	
11/6/2003	11:37	20.20	2.56	183,793	100	14.81	21.38	6.92	
11/10/2003	10:45	20.20	2.37	197,782	100	14.77	21.47	6.92	
11/13/2003	9:50	20.20	2.49	208,229	100	14.28	21.86	6.93	
11/17/2003	9:37	20.23	2.49	222,497	95	13.64	22.17	6.96	
11/20/2003	9:43	20.22	2.49	233,060	90	11.76	22.40	6.99	
11/24/2003	10:35	20.20	2.43	247,180	90	9.65	22.52	7.00	
12/1/2003	9:54	20.20	2.57	270,831	80	10.29	21.82	7.06	
12/4/2003	9:21	20.20	2.37	280,874	80	9.87	22.37	6.98	Pump lowered 2 ft on 12/4/03
12/8/2003	10:10	20.90	2.75	296,609	110	14.00	12.52	6.92	Adjusted pressure to 120, flow 2.43
12/11/2003	9:40	20.45	2.43	306,972	122	12.74	22.28	6.95	
12/15/2003	9:46	20.62	2.43	320,916	122	12.34	22.09	6.94	
12/18/2003	9:17	20.65	2.43	331,246	122	10.05	22.4	6.96	
12/22/2003	9:34	20.60	2.43	345,274	120	11.81	22.37	6.90	
12/27/2003	13:00								Power failure - shut system down for winter

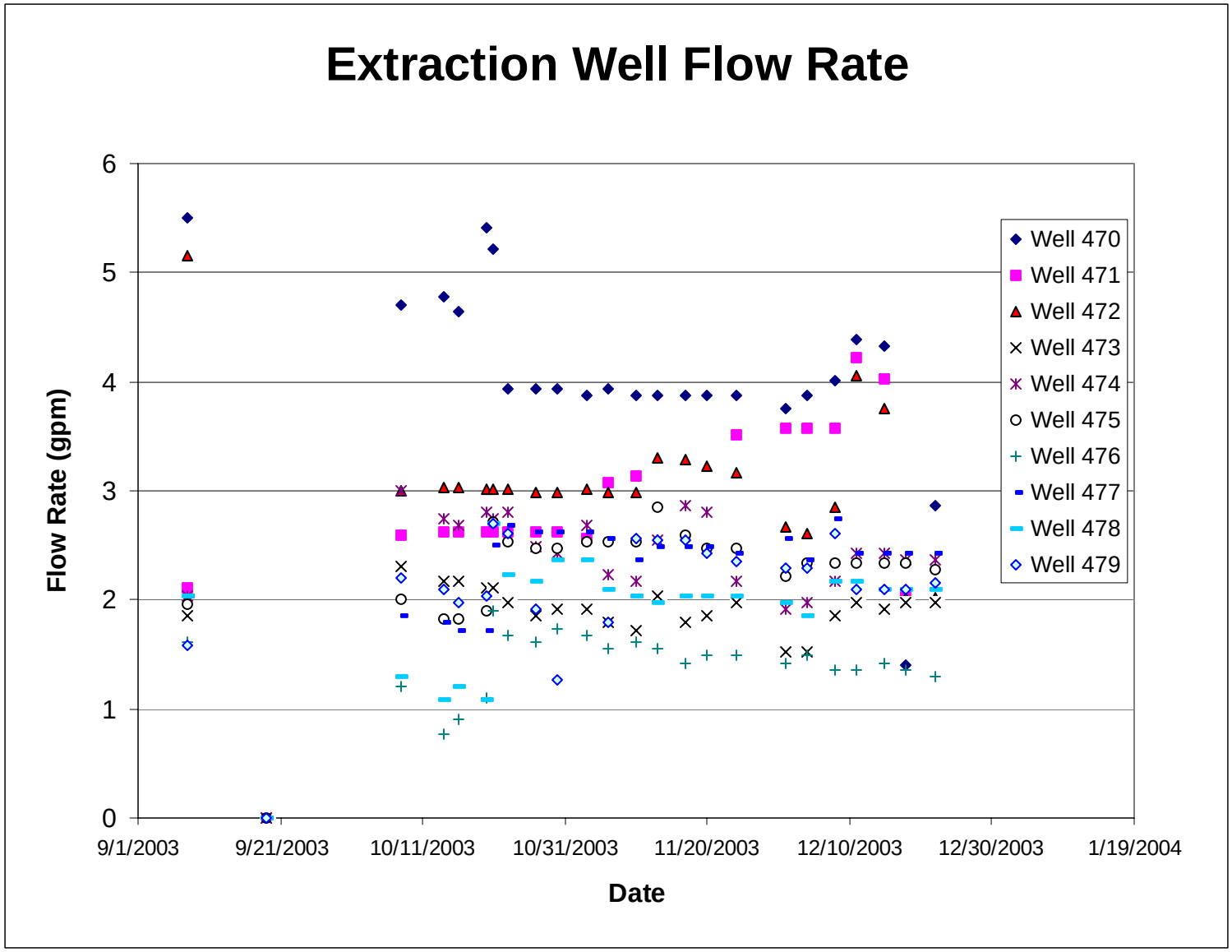
Date	Time	Well 478							comments
		Depth to water (ft)	flow rate gpm	total vol (l) gls	pressure psi	temp °C	spec cond µS/cm x1K	pH	
9/8/2003	12:25	18.95	2.04	17,745	125	17.90	25.15	6.87	
9/17/2003	14:05	16.62							Pump off
9/19/2003	8:00	16.71	0.00						system off since 9/8/03
10/8/2003	10:27	18.92	1.30	61,007	86	18.60	22.06	7.05	
10/14/2003	2:17	18.90	1.08	71,227	84	18.56	20.50	7.03	
10/16/2003	10:00	18.90	1.21	74,239	88	17.15	20.09	7.09	Pump kicked off while sampling
10/20/2003	10:10	18.90	1.08	80,817	82	16.51	20.36	7.14	
10/21/2003	15:16	19.80	2.70	82,660	125	17.62	20.76	6.97	
10/23/2003	9:55	20.15	2.23	88,869	104	16.24	20.94	7.01	Milky
10/27/2003	9:40	20.18	2.17	101,714	100	15.75	20.99	6.99	Milky
10/30/2003	9:04	20.18	2.36	111,401	100	16.25	21.14	6.97	Milky
11/3/2003	9:40	20.20	2.36	124,659	110	15.59	21.16	7.01	
11/6/2003	11:31	20.20	2.10	134,301	90	14.59	22.44	7.04	
11/10/2003	10:39	20.20	2.04	145,802	90	15.40	23.30	6.11	
11/13/2003	9:40	20.20	1.98	154,493	90	14.04	22.17	7.05	
11/17/2003	9:31	20.23	2.04	166,319	104	14.41	22.63	6.95	
11/20/2003	9:34	20.20	2.04	175,012	90	12.30	22.38	6.96	
11/24/2003	10:27	20.20	2.04	186,964	90	10.77	23.14	7.00	
12/1/2003	9:47	20.20	1.98	207,339	80	11.25	22.76	6.98	
12/4/2003	9:15	20.10	1.85	215,880	80	11.33	23.11	6.96	Pump lowered 2 ft on 12/4/03
12/8/2003	9:15	20.50	2.17	228,003	124	14.51	23.43	6.98	
12/11/2003	9:36	20.55	2.17	237,273	124	13.16	23.84	6.93	
12/15/2003	9:40	20.82	2.10	299,658	125	12.57	23.40	6.92	Probe stuck
12/18/2003	9:11	20.82	2.1	258,770	124	11.6	24.11	6.94	
12/22/2003	9:26	20.78	2.10	271,076	124	12.79	24.66	6.89	
12/27/2003	13:00								Power failure - shut system down for winter

Date	Time	Well 479							comments
		Depth to Water	flow rate gpm	total vol (l) gls	pressure psi	temp °C	spec cond µS/cm x1K	pH	
9/8/2003	12:31	18.40	1.59	41,865	120	17.50	21.68	6.86	
9/17/2003	12:35	16.21							Pump off
9/19/2003	8:00	16.37	0.00						system off since 9/8/03
10/8/2003	10:28	18.96	2.20	98,580	110	18.00	21.51	6.97	
10/14/2003	2:30	18.80	2.10	117,122	105	17.82	19.90	7.02	
10/16/2003	9:50	19.92	1.97	122,411	100	17.44	20.11	7.01	
10/20/2003	9:55	18.75	2.04	134,113	100	17.07	19.97	6.97	
10/21/2003	15:19	18.70	2.70	137,461	125	17.62	20.32	6.96	
10/23/2003	9:40	19.94	2.61	144,197	124	16.28	21.20	6.98	
10/27/2003	9:30	18.78	1.91	154,753	90	16.94	20.56	6.94	
10/30/2003	9:02	18.05	1.27	160,207	70	17.80	20.78	6.95	
11/3/2003									well not pumping (bad pump?)
11/6/2003	11:22	18.42	1.79	165,880	130	17.10	20.48	6.87	pump was replaced on 11/4/03
11/10/2003	10:30	20.45	2.57	181,865	110	16.02	22.59	6.86	
11/13/2003	9:33	20.42	2.55	192,731	104	15.76	22.47	6.91	
11/17/2003	9:25	20.43	2.55	207,251	104	16.07	22.76	6.86	
11/20/2003	9:28	19.43	2.42	217,670	100	14.45	22.76	6.88	
11/24/2003	10:18	20.45	2.35	231,471	100	13.12	22.56	6.90	
12/1/2003	9:40	20.45	2.29	254,424	85	14.32	22.81	6.83	
12/4/2003	9:08	19.83	2.29	264,039	90	14.77	22.84	6.97	Pump lowered 3 ft on 12/4/03
12/8/2003	9:05	22.10	2.61	279,596	110	14.50	24.23	6.93	adjusted pressure to 126, flow 2.10
12/11/2003	9:30	19.90	2.10	288,827	126	13.48	21.98	6.93	
12/15/2003	9:28	20.20	2.10	301,003	126	13.74	22.24	6.92	
12/18/2003	9:05	20.4	2.1	310,066	126	14.89	23.32	6.92	
12/22/2003	9:20	20.38	2.16	322,363	126	14.83	23.09	6.88	
12/27/2003	13:00								Power failure - shut system down for winter

Date	Extraction Well										Total Flow (gpm)		
	470	471	472	473	474	475	476	477	478	479	wells	badger meter	difference
9/8/2003	5.5	2.11	5.15	1.85	2.04	1.96	1.62	2.04	2.04	1.59	25.9	check date	#VALUE!
9/17/2003	0	0	0	0	0	0	0	0	0	0	0	check date	#VALUE!
9/19/2003	0	0	0	0	0	0	0	0	0	0	0	check date	#VALUE!
10/8/2003	4.7	2.6	3	2.3	3	2	1.2	1.85	1.3	2.2	24.15	check date	#VALUE!
10/14/2003	4.78	2.62	3.03	2.17	2.74	1.83	0.77	1.79	1.08	2.1	22.91	24.8	-1.89
10/16/2003	4.65	2.62	3.03	2.17	2.68	1.83	0.9	1.72	1.21	1.97	22.78	31.04	-8.26
10/20/2003	5.41	2.62	3.01	2.11	2.81	1.9	1.1	1.72	1.08	2.04	23.8	31.95	-8.15
10/21/2003	5.22	2.62	3.01	2.11	2.74	2.72	1.9	2.5	2.7	2.7	28.22	29.7	-1.48
10/23/2003	3.94	2.62	3.01	1.98	2.81	2.53	1.68	2.68	2.23	2.61	26.09	29.099	-3.009
10/27/2003	3.94	2.62	2.99	1.85	2.49	2.47	1.62	2.62	2.17	1.91	24.68	25.976	-1.296
10/30/2003	3.94	2.62	2.99	1.92	2.42	2.47	1.74	2.62	2.36	1.27	24.35	25.4	-1.05
11/3/2003	3.88	2.56	3.01	1.92	2.68	2.53	1.68	2.62	2.36	0	23.24	24.31	-1.07
11/6/2003	3.94	3.07	2.99	1.79	2.23	2.53	1.55	2.56	2.1	1.79	24.55	25.092	-0.542
11/10/2003	3.88	3.13	2.99	1.72	2.17	2.53	1.62	2.37	2.04	2.57	25.02	26.41	-1.39
11/13/2003	3.88	0	3.3	2.04	2.55	2.85	1.55	2.49	1.98	2.55	23.19	24.452	-1.262
11/17/2003	3.88	0	3.29	1.79	2.87	2.6	1.42	2.49	2.04	2.55	22.93	23.8	-0.87
11/20/2003	3.88	0	3.23	1.85	2.81	2.47	1.49	2.49	2.04	2.42	22.68	24.171	-1.491
11/24/2003	3.88	3.52	3.16	1.98	2.17	2.47	1.49	2.43	2.04	2.35	25.49	23.962	1.528
12/1/2003	3.75	3.58	2.67	1.53	1.91	2.22	1.42	2.57	1.98	2.29	23.92	26.748	-2.828
12/4/2003	3.88	3.58	2.61	1.53	1.98	2.34	1.49	2.37	1.85	2.29	23.92	26.252	-2.332
12/8/2003	4.01	3.58	2.85	1.85	2.17	2.34	1.36	2.75	2.17	2.61	25.69	25.06	0.63
12/11/2003	4.39	4.22	4.05	1.98	2.42	2.34	1.36	2.43	2.17	2.1	27.46	28.367	-0.907
12/15/2003	4.33	4.03	3.76	1.92	2.42	2.34	1.42	2.43	2.1	2.1	26.85	29.32	-2.47
12/18/2003	1.4	2.04	2.02	1.98	2.36	2.34	1.36	2.43	2.1	2.1	20.13	26.748	-6.618
12/22/2003	2.86	1.98	2.02	1.98	2.36	2.28	1.29	2.43	2.1	2.16	21.46	22.642	-1.182
12/27/2003	0	0	0	0	0	0	0	0	0	0	0	0	0

Date	Extraction Well										Total Volume (gallons)		
	470	471	472	473	474	475	476	477	478	479	Wells	Badger Meter	Difference
9/8/2003	81814	44850	0	40513	39784	37266	32377	36933	17745	41865	373147	check date	#VALUE!
9/17/2003	0	0	0	0	0	0	0	0	0	0	0	check date	#VALUE!
9/19/2003	0	0	0	0	0	0	0	0	0	0	0	check date	#VALUE!
10/8/2003	217500	116913	60334	98009	103837	86549	46316	90069	61006.7	98579.9	979113.6	check date	#VALUE!
10/14/2003	253214	139938	0	115805	129163	99637	53299	105770	71227	117122	1085175	1583621	-498446
10/16/2003	265531	147468	83758.9	121682	136707	103797	55423	110429	74239	122411	1221446	1654100	-432654
10/20/2003	289573	162486	94459.9	133597	152387	111977	60191	120644	80817	134113	1340245	1803699	-463454
10/21/2003	295598	166519	97359.1	136811	156746	114188	61406	123474	82660	137461	1372222	1845232	-473010
10/23/2003	306543	173749	102518	142332	162691	121226	66179	130782	88869	144197	1439086	1917433	-478347
10/27/2003	329338	188904	113407	153368	176162	135380	75416	145946	101714	154753	1574388	2074730	-500342
10/30/2003	345979	200040	121381	161475	186763	145996	82668	157236	111401	160207	1673146	2190682	-517536
11/3/2003	368752	215105	132941	172832	200908	160319	91385	172441	124659	0	1639342	2344141	-704799
11/6/2003	386061	226351	145919	181193	211328	170983	98187	183793	134301	165880	1903996	2462959	-558963
11/10/2003	408127	243789	163649	191216	224115	184005	106966	197782	145802	181865	2047316	2585897	-538581
11/13/2003	424638	0	176253	198594	233968	184384	133621	208229	154493	192731	1906911	2663100	-756189
11/13/2003	check date	check date	check date	check date	check date	check date	check date	check date	check date	check date	0	check date	#VALUE!
11/20/2003	436491	0	208316	216390	256432	219787	128448	233060	175012	217670	2091606	2845272	-753666
11/24/2003	486187	243930	226429	226199	269658	234105	137148	247180	186964	231471	2489271	2950565	-461294
12/1/2003	524733	278887	253336	241030	290953	257816	151478	270831	207339	254424	2730827	3138324	-407497
12/4/2003	541033	294160	264371	247177	299244	267752	157391	280874	215880	264039	2831921	3216976	-385055
12/8/2003	563767	314995	279257	255702	308410	280955	165091	296609	228003	279596	2972385	3359982	-387597
12/11/2003	581461	332173	296503	264708	314807	290840	171011	306972	237273	288827	3084575	3495220	-410645
12/15/2003	606119	356222	318428	276081	328614	304252	118969	320916	299658	301003	3230262	3703364	-473102
12/18/2003	619456	370400	331199	284525	338769	314163	184901	331246	258770	310066	3343495	3832126	-488631
12/22/2003	636336	382095	392043	296052	352622	327621	192654	345274	271076	322363	3518136	3936619	-418483


Extraction Well Depth to Water
Depth to Water (ft)
22
21
20
19
18
17
9/1/2003
9/21/2003
10/11/2003
10/31/2003
11/20/2003
12/10/2003
12/30/2003
1/19/2004
Date
Well 470
Well 471
Well 472
Well 473
Well 474
Well 475
Well 476
Well 477
Well 478
Well 479


Extraction Well Flow Rate
Flow Rate (gpm)
0
1
2
3
4
5
6
9/1/2003
9/21/2003
10/11/2003
10/31/2003
11/20/2003
12/10/2003
12/30/2003
1/19/2004
Date
Well 470
Well 471
Well 472
Well 473
Well 474
Well 475
Well 476
Well 477
Well 478
Well 479

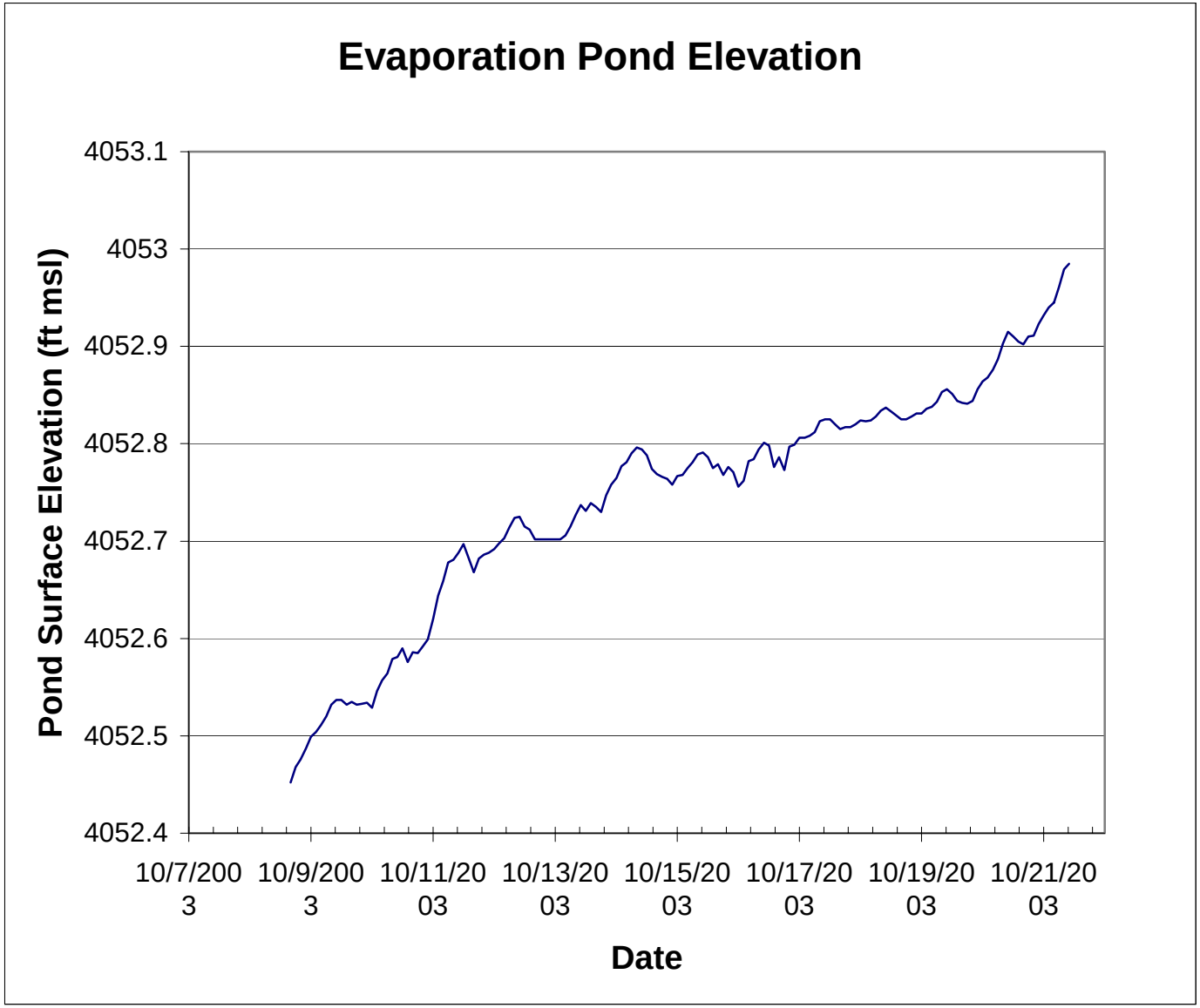
Date	Time	Observation Well Depth to water (ft)						Observation Well Ground Water Elevation (ft msl))						Comments
		480	481	482	483	484	485	480	481	482	483	484	485	
9/8/2003	12:55	17.18	16.35	17.03	17.46	17.00	16.65	3951.47	3952.48	3951.67	3951.44	3952.19	3952.16	
9/18/2003	18:40	16.04	15.98	16.93	16.29	16.47	16.53	3952.61	3952.85	3951.77	3952.61	3952.72	3952.28	system shut down since 9/8/03
9/19/2003	8:00	16.05	16.02	16.96	16.33	16.51	16.58	3952.60	3952.81	3951.74	3952.57	3952.68	3952.23	system shut down since 9/8/03
10/8/2003	10:46	17.34	16.53	17.17	17.65	17.18	16.78	3951.31	3952.30	3951.53	3951.25	3952.01	3952.03	
10/16/2003	11:39	17.39	16.59	17.20	17.70	17.23	16.80	3951.26	3952.24	3951.50	3951.20	3951.96	3952.01	
10/30/2003	9:44	17.43	16.48	17.02	17.80	17.20	16.65	3951.22	3952.35	3951.68	3951.10	3951.99	3952.16	
11/6/2003	12:31	17.48	16.54	17.10	17.80	17.25	16.70	3951.17	3952.29	3951.60	3951.10	3951.94	3952.11	
11/13/2003	11:00	17.43	16.53	17.02	17.78	17.23	16.65	3951.22	3952.30	3951.68	3951.12	3951.96	3952.16	
11/17/2003	10:30	17.40	16.50	17.02	17.78	17.23	16.63	3951.25	3952.33	3951.68	3951.12	3951.96	3952.18	
11/20/2003	10:40	17.43	16.50	17.00	17.80	17.23	16.63	3951.22	3952.33	3951.70	3951.10	3951.96	3952.18	
11/24/2003	11:39	17.45	16.50	17.00	17.83	17.23	16.60	3951.20	3952.33	3951.70	3951.07	3951.96	3952.21	
12/1/2003	10:56	17.55	16.62	17.10	17.90	17.34	16.72	3951.10	3952.21	3951.60	3951.00	3951.85	3952.09	
12/4/2003	10:06	17.53	16.62	17.10	17.90	17.35	16.70	3951.12	3952.21	3951.60	3951.00	3951.84	3952.11	
12/8/2003	11:08	17.38	16.53	17.02	17.68	17.25	16.63	3951.27	3952.30	3951.68	3951.22	3951.94	3952.18	
12/11/2003	10:36	17.65	16.58	17.00	17.93	17.34	16.62	3951.00	3952.25	3951.70	3950.97	3951.85	3952.19	
12/15/2003	10:10	17.62	16.75	17.18	18.00	17.48	16.78	3951.03	3952.08	3951.52	3950.90	3951.71	3952.03	
12/18/2003	10:11	17.6	16.68	17.1	17.98	17.43	16.75	3951.05	3952.15	3951.60	3950.92	3951.76	3952.06	
12/22/2003	10:27	17.54	16.65	17.1	17.9	17.4	16.7	3951.11	3952.18	3951.60	3951.00	3951.79	3952.11	

Appendix C

Evaporation Pond Data

Date	Time	day	IA Pond										Badger Meter (Totalizer)				comments
			level ft	L	A1	A2	A3	total A	volume gls	volume change gls	rate gpm	surface area ac	flow rate gpm	total vol (l) gls	pressure psi	trip vol (2) gls	
9/25/2003	10:00	37889.42	2.8	636	11.08743	33.6	65.22872	109.9162	508,224			1.0	29.78	765,105	43		
10/6/2003	14:30	37900.60	3.8	641	20.42124	45.6	120.1406	186.1619	875,330	367,106	22.8	1.3	24.50	1,226,149	44		
10/8/2003	10:30	37902.44	4						960,983	85,653	32.4		30.50	1,319,164	44		
10/13/2003	8:30	37907.35	4.25	644	25.54423	51	150.2798	226.824	1,073,782	112,799	15.9	1.4	24.80	1,539,171	44		
10/14/2003	8:05	37908.34	4.3	644	26.14881	51.6	153.8366	231.5854	1,097,107	23,324	16.5	1.5	24.80	1,583,621	44		
10/16/2003	8:15	37910.34	4.4	645	27.37917	52.8	161.075	241.2542	1,144,520	47,413	16.4	1.5	31.04	1,654,100	44		
10/20/2003	8:15	37914.34	4.6	646	29.92476	55.2	176.051	261.1757	1,242,404	97,884	17.0	1.5	31.95	1,803,699	44		
10/21/2003	13:00	37915.54											29.70	1,845,232	44		
10/23/2003	9:30	37917.40	4.75	647	31.90819	57	187.7198	276.628	1,318,492	76,089	17.3	1.6	29.10	1,917,433	44		
10/27/2003	9:20	37921.39		620	0	0	0	0					25.98	2,074,730	44		
10/30/2003	9:00	37924.38	5.15	649	37.50848	61.8	220.6669	319.9754	1,532,607	214,115	49.8	1.7	25.40	2,190,682	44		
11/3/2003	7:45	37928.32	5.35	650	40.47833	64.2	238.1389	342.8172	1,645,780	113,173	19.9	1.8	24.31	2,344,141	45		
11/6/2003	11:20	37931.47	5.5	651	42.77996	66	251.6797	360.4596	1,733,336	87,556	19.3	1.8	25.09	2,462,959	44		
11/10/2003	7:50	37935.33	5.75	653	46.75744	69	275.0797	390.8371	1,884,358	151,022	27.2	1.9	26.41	2,585,897	44		
11/13/2003	9:20	37938.39	5.95	654	50.0667	71.4	294.5484	416.0151	2,009,763	125,405	28.4	2.0	24.45	2,663,100	44		
11/17/2003	9:15	37942.39	6.1	655	52.62289	73.2	309.5868	435.4097	2,106,492	96,729	16.8	2.0	23.80	2,776,982	44		
11/20/2003	9:20	37945.39	6.25	655	55.24272	75	324.9996	455.2423	2,205,514	99,022	22.9	2.1	24.17	2,845,272	44		
11/24/2003	10:10	37949.42	6.9	659	67.33071	82.8	396.1147	546.2454	2,661,113	455,598	78.4	2.3	23.96	2,950,565	44		
12/1/2003	8:40	37956.36	7.15	660	72.29813	85.8	425.3387	583.4368	2,847,810	186,697	18.7	2.3	26.75	3,138,324	44		
12/4/2003	8:05	37959.34	6.98	659	68.90105	83.76	405.3532	558.0143	2,720,163	-127,647	-29.8	2.3	26.25	3,216,976	44		
12/8/2003	8:59	37963.37	7.2	661	73.31283	86.4	431.3083	591.0211	2,885,914	165,751	28.5	2.4	25.06	3,359,982	44		
12/11/2003	9:22	37966.39	7.35	662	76.39935	88.2	449.4666	614.066	3,001,754	115,841	26.7	2.4	28.37	3,495,220	44		
12/15/2003	8:15	37970.34	7.5	662	79.54951	90	467.9994	637.5489	3,119,888	118,134	20.8	2.4	29.32	3,703,364	44		
12/18/2003	8:59	37973.37	7.65	663	82.76331	91.8	486.9066	661.4699	3,240,315	120,427	27.6	2.5	26.75	3,832,126	44		
12/22/2003	9:18	37977.39	7.8	664	86.04075	93.6	506.1882	685.8289	3,363,036	122,721	21.2	2.5	22.642	3,936,619	44.0		
12/27/2003	13:00	37982.54		620	0	0	0	0									

Date	Time	Inlet Sample			Recirculating Sample			comments
		temp C	spec cond µS/cm x1K	pH	temp C	spec cond µS/cm x1K	pH	
9/25/2003	10:00							
10/6/2003	14:30							
10/8/2003	10:30	20.46	27.26	6.88	21.73	28.52	7.81	
10/13/2003	8:30							
10/14/2003	8:05							
10/16/2003	8:15	15.3	24.99	6.95	12.72	26.48	8.08	
10/20/2003	8:15							
10/21/2003	13:00							Flow too high
10/23/2003	9:30	15.13	23.91	6.99	14.30	27.22	8.04	
10/27/2003	9:20							
10/30/2003	9:00	15.45	24.42	7.02	9.46	28.03	8.14	
11/3/2003	7:45							
11/6/2003	11:20	15.26	25.79	6.91	7.21	29.64	8.01	
11/10/2003	7:50							
11/13/2003	9:20	15.68	24.61	6.88	8.80	29.54	7.97	
11/17/2003	9:15							
11/20/2003	9:20	13.68	25.26	6.89	5.12	29.50	8.08	
11/24/2003	10:10							
12/1/2003	8:40	13.42						
12/4/2003	8:05	13.02	26.42	6.99	1.96	21.50	8.01	Spec cond value suspect
12/8/2003	8:59	13.77						
12/11/2003	9:22	13.73	29.28	6.95	2.33	27.14	8.03	
12/15/2003	8:15	12.37			2.00			
12/18/2003	8:59							
12/22/2003	9:18							
12/27/2003	13:00							Power failure - shut system down


Evaporation Pond Elevation
Pond Surface Elevation (ft msl)
4053.1
4053
4052.9
4052.8
4052.7
4052.6
4052.5
4052.4
10/7/2003
10/9/2003
10/11/2003
10/13/2003
10/15/2003
10/17/2003
10/19/2003
10/21/2003
Date